ENGINEERING NEWS.

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TWO highway bridges have fallen this week, from weakness and neglect, both in Kentucky, with fatal results. One in Caseyville, Ky., a large covered bridge, under a wheat separator, killing one man (probably not a commissioner) and precipitating six mules into the stream, which, we are happy to say, escaped injury, and one at Sturgis, Ky., of 90 ft. span, under a threshing machine, also killing one man. Of the multitudes of these structures which fall killing no one we get few records, and of course such are the majority.

THERE is a somewhat undefined rumor abroad that ex-mayor Grace of this city and his brother MICHAEL P. GRACE, (who by the by was *not* killed by Apaches in New Mexico recently as he happened to be in London at the time,) are now "about completing syndicate arrangements for a stupendous financial experiment in Peru." This scheme is said to contemplate the assumption of the entire national debt of Peru, mainly incurred in the war with Chili. In return the syndicate is to be guaranteed all railway, telegraph and telephone privileges by the Peruvian government for an indefinite period.

THE Penna. R. R. Co. is handling the question of short-span railroad bridges in a very sensible and thoroughly satisfactory manner by substituting stone arches for iron structures at many points along its main line from Jersey City to Pittsburg. Last week we noted the shifting of the Conemaugh bridge, 250 ft. long, preparatory to the building of the proposed arches, and on last Sunday the iron bridge at the Holmesburg Junction was also transferred to temporary bridge seats in 11½ minutes for a similar purpose. We understand that like preparations are being made at the Conestoga bridge, near Lancaster, Pa. and at other points for a substitution of stone arches. The Conestoga bridge is quite an important structure, being about 100 ft. above the water and about 500 ft. long.

The process of transfer of trusses in these cases is really very simple. Strong trestle approaches and new trestle bridge-seats, and piers, if required, are built at a point 75 or 80 ft. to one side or the other of the line of the road and a solid trestle connection made between the old and new bridge sites. On these connecting trestles are laid two bars of railroad iron at either end of each truss and the truss is jacked up so as to rest upon these rails. All is then ready for the transfer and at the proper time the old line is cut, proper tackle connected to the truss, and by crabs worked by a small army of laborers the truss or trusses slide over on the well greased rails to the new site, and the new rail connections are made.

THE Market St. Bridge, across the Schuylkill river in Philadelphia, is progressing rapidly. The river and shore piers are completed, and the iron work of the east and west shore spans is nw being put into position. This will be a cantilever bridge and was fully described and illustrated in our issue of Oct. 16, 1886.

THE promotors of the proposed Philadelphia elevated road are meeting with difficulties on the routes laid down. The 13th. & 15th. Sts. surface railway company confront them with a contract with the State, made in 1870, and granting them exclusive use of these two streets for an unlimited period as compensation for the surrender of charter-rights on Broad St. The property owners along the line are also organizing a vigorous opposition.

ONLY 280 ft. of the Washington Aqueduct tunnel remain undriven. When this is done the 21,000 ft. of tunnel will be completed, only lacking lining in some portions. The inner reservoir is not yet finished. This tunnel was authorized by act of Congress of July 15, 1882 and the work of tunneling was let to Messrs. Beckwith & Quackenbush in Oct., 1883, for the sum of $548,000. About the same time Chittenden Bros. were awarded the work on the Potomac dam for $94,293,75, and the reservoir construction was given to Maloney & Gleason for $298,980.

THE report of the British Suez Canal Directors shows a considerable falling off in vessels and tonnage for 1886 as compared with 1885. The number of vessels was less by 534 and net tonnage by 568,097 tons. With the same rate for both years the receipts were decreased by 5,680,049 francs. The British tonnage was 77 per cent. of the total. In 1886 the canal was opened to night traffic over a part of its length only, but even then the transit time was reduced from the average 36 hours to 20 hours. This year, from March 1, the entire canal was thrown open to night traffic and vessels can now pass through easily in 16 hours.

ON June 16 the Tay Bridge was officially inspected by the Board of Trade. The method of building the piers was first examined. Sixteen engines, weighing 950 tons, were then run out on the girder at pier 41 and a deflexion of 1⅝ in. noted but no permanent set. Each girder was tested in the same manner and with similar results. The inspecting officers expressed themselves as being highly satisfied with the results.

THE Great Southern of Spain Railway Co. has been incorporated in England to construct a line in Spain from Granada to Lorca, connecting two systems of railway and forming an important link. The Chief Engineer is GEORGE HIGGIN, M. Inst. C. E., of London. The net earnings of the five principal railway companies, representing a total mileage of 3,724 miles, for the five years ending 1885 (the last published) gave an average of $3,910 per mile. The lines which border on the district to be opened up by the new line gave in 1885 the following results:

Line.	Length Open.	Gross Earnings.	Working Expenses.	Net Earnings.	Net Earnings per Mile.
	Mls	$	$	$	$
Carthagena, Murcia, Alicante & Madrid	451	4,348,840	1,813,445	2,535,395	5,621
Manzanares, Cordova, Seville, Malaga & Granada	498	3,317,615	1,403,990	1,913,725	3,843
Seville to Cadiz.	98	708,525	265,215	443,310	4,523

A well known Swedish ship-building firm, the Motala company, is about to establish a yard at Bakú, on the Caspian Sea. It is proposed to there repair the petroleum tank-steamers, of which there are now 100 on the Caspian, and also to build new steamers. At the present time the only ship-yard is at Astrakan on the Volga, a point often inaccessible on account of low-water or ice in winter.

THE *Isthmus*, of Colon, makes a note of the departure for New York, for a short absence, of Mr. H. B. SLAVEN, President and General Manager of the American Contracting & Dredging Co. Both the *Isthmus* and the Panama *Star and Herald* unite in commending the work done by this company, of which Mr. SLAVEN has been the head from the inception of the Canal enterprise. This American company has done very nearly as much in actual canal-making as all the other contractors combined, having taken out to date a "useful cube" of more than 10,000,000 cu. metres with seven of the monster dredges built by the company for this especial work, and of which a view is given elsewhere. This work has been done in the axis of the canal, and in the "derivations" made for the Chagres, Trinidad and Gatun rivers. Their contract, which will probably be completed next year, is the very greatest ever carried out by one company.

RUMOR has it that Russia has definitely resolved upon the building of a railroad to the Pacific Ocean by way of Siberia, and work is to be commenced upon it "next spring." As outlined in the press reports, this railroad would start at Tomsk, on the Obi river, in Siberia, which we believe has no railroad communication with Europe nearer than Orensburg, which is about 1,200 miles west. From Tomsk the road is to run to Vladivostock, on the Sea of Japan, via Irkutsk, Stretinsk and Hankoi. This route would indicate very difficult work among the compact mass of mountain ranges, forming the northern boundary of the Chinese empire, until the valley of the Amoor river was reached. As outlined, the route from Tomsk to the Sea of Japan, would be about 3,000 miles, and we doubt if even the phenomenal "push" of the Russians will induce them to expend the amount of solid cash such a railway enterprise would demand. If China is the objective point, as it would seem, there is a shorter road.

DURING the week, bridges have been washed out on the Southern Pacific Railroad and Northern Pacific Railroad, and a washout has occurred on the Matamoros & Monterey Railroad in Texas. A highway bridge at Rome, N. Y., was partly wrecked June 22, by the giving way of an abutment that had been undermined by the water.

THE most serious railroad accident of the week occurred June 23, and was caused by a broken rail on the Baltimore & Ohio Railroad near Snowy creek, Md. The engine passed over safely, but the cars were thrown down a 30-ft. embankment and badly wrecked. One man was killed and 6 persons injured.——Two collisions had results nearly as serious as the above accident. One on the Connecting Railroad, Philadelphia, June 25, caused by neglect of signals and the other on the Baltimore & Ohio Railroad at Barracksville, W. Va., caused by the second section of a freight train running too close after the preceding section and unable to stop in time when flagged. In both cases the cars were burnt.

The Nature and Causes Connected with Location which Modify the Volume of Railway Revenue.

[From "The Economic Theory of the Location of Railways." By A. M. Wellington, C. E.]

With the invention of the railway began a new industry—the MANUFACTURE OF TRANSPORTATION. Transportation, indeed, existed before its invention, just as cotton cloth existed before the invention of modern machinery, but it was in each case mainly produced on a small scale by each consumer for his own use and his immediate neighbors'. With the invention of the railway first began the manufacture of transportation for sale on a large scale and by modern processes.

A railway corporation such as has been just considered—the typical modern corporation—exists for this purpose. It finds itself, on completion of its works, in possession of a certain piece of improved real estate, of certain buildings and fixed machinery (the track), and of certain tools and machines (the rolling-stock) for the manufacture of its commodities, together with certain establishments (the locomotives and car shops) for the maintenance and repair of its machine-tools, which the extent of its business requires. In many instances it has not a dollar's worth of ownership interest in all this costly plant, excepting a portion of the minor machinery, but simply controls it at, in effect, a fixed rental (interest and other fixed charges). All that it really owns is, commonly, a portion of the business or franchise; and this latter has likewise been hypothecated, or pledged, in the mortgage bonds as security for the payment of of its rent charges. As this business has, from the nature of railway business assurance of always amounting to a certain minimum at least, this franchise alone has a value as security which no ordinary business would have, and in a rapidly growing country its existence enables all or nearly all of the actual cost of the entire premises and plant to be borrowed, or rented, from others.

On the premises so rented, the corporation carries on, for its own benefit, the business of manufacturing and selling transportation, so to speak, at wholesale and retail, in lots to suit the purchasers. Since it owns the business only, and has, as a corporate body, no interest or ownership in the property itself, it will be clear, and should be fully realized, that ALL its interests are limited to the narrow debatable ground which lies between doing the best possible and doing the worst possible with the property in hand, which is in all ordinary cases simply lent to them for an annual consideration.

Now, continuing the parallel, which will perhaps help to enforce the truths required, and referring only to sales of transportation, or revenue: if a manufacturing company in such circumstances should, in planning its works, so plan them as to cut itself off from disposing of certain lines of goods which it manufactures, or should place its retailing establishments (stations) at inconvenient points, it is clear that it would have seriously handicapped itself, even if, perchance, justifiably. This a railway company does when, by failing to run close to any accessible towns, it is prevented from furnishing them with transportation, or is so far away that sales are inconvenient. If it strives to shorten its line it is, for certain parts of its traffic, trying to sell less *yards* of its goods, at a certain price *per yard*, in order, to save the cost of its manufacture; forgetting that by the same act it also loses the selling price and hence the profit on them If, on the contrary, it builds an over-long, or crooked, or otherwise objectionable line, it is in effect fitting itself to produce only an inferior article, which will command a lower price.

The force of this parallel is still further and greatly strengthened if we remember that, with much that is similar, there is, in one respect, a momentous and broad distinction between the seller of transportation and the seller of most other commodities. The production or partial production of transportation is, from the necessity of the business, considerably in excess of the amount sold, and its cost bears a very irregular ratio thereto. Every time, for example, a passenger train starts out, there is "manufactured," so to speak, several hundred passenger trips. If they be not sold, they cannot be stored away on the shelf for the next day's trade, like the remnants of a lot of dry goods. They are simply wasted and thrown away. It is with the railway much as if tradesmen were compelled to cut a new piece of each kind of goods each day and then throw away the part remaining unsold each night. We should probably under such circumstances observe a conspicuously greater zeal even than now exists for regulating and increasing sales, so as to sell the whole of every piece of goods; whatever price the remnants might bring being so much clear gain.

To a greater or less degree, but always to a very important degree, the conditions here suggested exist with respect to every part and kind of railway traffic. We see, therefore, how vital and peculiar is the interest of railways in neglecting no consideration which by ever so little affects its revenue. It is on slight differences of traffic and revenue that the corporation grows rich or poor.

Granting, therefore, that no probable effect upon traffic and revenue which may or can occur from the decisions reached in the original location should be neglected, it will be obvious, as already hinted, that such effects are possible from any one of the following causes:

1. THE LENGTH OF THE LINE.—Even slight variations therein are very certain to affect the revenue, as well as the expenses; because all local rates, except by special contract, are nominally fixed by the mile, and all through rates (those shared in by two or more companies) are, without exception, divided according to distance hauled, although not necessarily in exact ratio thereto.

Up to a certain point, therefore, varying in almost every case, the gross revenue certainly, and the net revenue frequently, will be increased by a longer line, as well as the operating expenses. But if the process be carried too far, the traffic will be overburdened, discouraged and decreased. The questions thus raised will be separately discussed in Chapter VII., on Distance. It is one of extreme importance.

Such effects on revenue may also occur from—

2. THE COMPARATIVE WEIGHT ALLOWED TO SECURING WAY TRAFFIC, the quantity which may be expected, and the sacrifices which may or must be made to reach certain additional traffic points. Also,

3. Allied to the latter, is the question of HOW NEAR TO RUN TO CITIES, TOWNS, AND OTHER SOURCES OF TRAFFIC, which are already upon the line, and how much the traffic and revenue will be thereby affected.

4. Still other similar questions arise in connection with BRANCH LINES: whether to build a branch at all, or take the main line through the given point; whether, if a branch be decided on, the connection should be made at this or that point, there being often much choice, and the decision governed by commercial considerations to an unusual extent, or at least by very different laws from those which might govern the laying out of longer lines, owing to the shortness and isolation of most branches.

5. All of these questions together arise on a grand scale in the laying out of GREAT SYSTEMS OF RAILWAY at once or in the connection of a number of isolated lines into a single system, as happens with increasing frequency in modern times.

In a certain sense, indeed, every line, even nominally independent, and no matter how short, is a part not only of one but perhaps of several great systems of roads. On this account, and because of the great importance of the questions which arise in connection with the laying out of branch lines and systems, a separate chapter (XXI.) is devoted hereafter to—not a general discussion, for that is impossible—but to the presentation of certain suggestions intended to illustrate the laws which govern their solution. Much of the chapter referred to has likewise a direct bearing on the remainder of this chapter.

It is unfortunate that the very great and often decisive effect which differences of location may have upon the revenue of railways is not susceptible of more exact analysis, for it is very often, in properly conducted work, a consideration of such importance as to sink differences of engineering details into insignificance. The most that can be done is to lay down with all possible care the general principles which govern this effect, with the caution that the very difficulty of determining *exactly* what weight should be given to it creates too great a tendency to neglect it altogether.

(To be Continued.)

Some Notes on Municipal Public Works.*

BY THOMAS APPLETON, MEM. OF THE BOSTON SOC. OF C. E.

This paper treats of the methods of defraying the expense and assessing the cost of public improvements in cities in the west, with which the writer is familiar. Some cities have saddled themselves with heavy loads of debt, incurred in making improvements more rapidly than their circumstances warranted, and have been compelled to make a radical change of methods and peremptorily stop the issue of bonds for public improvements. Kansas City, in its early days, like many other western cities, issued bonds with a reckless prodigality for public improvements and in aid of railroads. It was found necessary to forbid the increase of debt for any purpose. The charter under which it has been governed for the past few years forbids the appropriation of a single dollar for any purpose unless the money is actually in the treasury at the time. It has been found necessary, therefore, to assess the entire cost of improving streets, building sewers, etc., upon the property benefited. The grading, curbing and paving of streets is assessed directly upon the abutting property in proportion to its frontage. The whole cost of the improvement, from end to end, including street intersection, is assessed upon the property. Where the city owns a lot abutting on a street thus grading or paved, the city pays its special tax bill just the same as an individual owner. The city at large pays all the engineering and inspection expenses, but all work and material which can be done or furnished by a contractor is included in contracts which are awarded to the lowest bidder after proper advertisement. The contract and advertisement state expressly that the city will not pay for the work except by the issue of special tax-bills, which are a lien upon the property benefited.

Sewers, in that city, are paid for in the same manner, excepting that instead of assessing the cost upon the foot front it is assessed upon the superficial area of each lot. The region to be sewered is divided into districts; each district is such a portion of the city as can conveniently be drained by one main or sub-main sewer. Usually the whole system of sewerage for a district is not built at once, but portions of it are built from year to year as the circumstances demand. But any sewer built in a district, whether it is the main sewer or a remote lateral, is paid for by the lots in the whole district in proportion to their areas. All of these public improvements, sewers, sidewalks, curbing, paving, or grading, are paid for in special tax-bills, against the property benefited. These bills are a peremptory demand against the owner for the full amount of the cost of the improvement and bear interest at heavy rates from 30 days after the date of issue. Many of the owners are not prepared to meet this immediate demand, and the contractors are obliged to wait, sometimes for years, for the final payments. For this reason any contractor who does public work and takes his pay in tax-bills must have a bank behind him, and the capital and risk must be paid for, consequently the prices are usually high. If the contractors were paid promptly in cash the cost of the work to the property owner would be much less than it is under the present system.

In Chicago, and some other cities, the cost of any contemplated improvement is estimated by the City Engineer, assessed upon the property benefited, and collected before the contract for the work is let. The estimates are generally made liberal, so as to be sure to cover the cost of the work, and no contract is awarded unless its total amount is less than the amount collected. After paying the contractor, the ballance of this special tax collected, if any, is refunded to the property owners. By this method the whole cost of the improvement must be paid at once by the property owner. But, as the contractor is paid in cash, the prices will be usually smaller than where he is paid in special tax-bills, as in Kansas City.

The thriving young city of East Saginaw, Mich., has methods of conducting public work which commend themselves to those who are conversant with them. To digress a little from the subject of assessing and paying the cost of improvements, the methods of planning the work in East Saginaw will be discussed. The waterworks are owned by the city, and the mains are extended and pumping works increased from time to time at the public expense. The sewerage system is planned in advance. A scheme of sewerage for the whole city has been made, adopted by the city council, and placed upon record in the county office. It cannot be changed without going through a considerable process of "red tape." This is a wise provision, for the plans are carefully studied and devised for the most perfect sewerage of the whole city, and should not be subject to change by ignorant or officious councilmen.

When it is proposed to pave any street the first questions are: Has the street a sewer, and are the water main and gas main laid? Is there any filling of the street required to bring it to grade? The city council has an established and well-observed rule that no street shall be paved until after these improvements have been made. In the early summer a list of streets to be paved is determined upon. The Water Board is notified, and they proceed to put in service pipes from the main to the sidewalk line opposite every lot. The lot owners are notified to make sewer connections forthwith, and in case any lot owner fails to do so the city puts in a six-inch sewer pipe connection from the sewer to the sidewalk line opposite every lot, and the cost of this connection is assessed upon the property benefitted and collected in the next tax roll. The gas company is also notified, and while they cannot be compelled to lay mains or put in service pipes, the company does as much of this work as it thinks is warranted by the circumstances. All this is done the year before the paving is commenced. By thus planning and executing the work in advance nearly all trenching or excavation of the street is done the year before the paving is executed. Trenches are carefully refilled, and they have the benefit of the rains and frosts to completely settle and compact the earth.

*From Journal of Association of Engineering Societies, June, 1887.

The most common style of pavement is composed of cedar blocks laid upon one-inch boards, with 3-ins. of river sand under the boards. The ground surface is carefully trimmed to conform to the shape of the roadway, and is thoroughly rolled with a steam road-roller. This work, when well done with a good quality of boards and cedar blocks, gives a smooth and durable pavement at a very small first cost. It is very rarely necessary to take up the pavement for the purpose of laying pipes of any kind. As an addititional incentive to induce property owners to make their sewer and water connections in advance, the city requires that when a property owner desires to take up pavement for such purposes, he shall pay into the treasury not only the whole cost of taking up and restoring the pavement, which is estimated by the Superintendent of Streets, but also an additional penalty of $25 to cover the depreciation of the pavement in consequence of its being thus disturbed. The work of taking up and restoring the pavement is done by experienced men employed by and under the direction of the Superintendent of Streets.

The contracts for paving are usually awarded in the winter and the work commenced as early in the spring as the condition of the ground will allow. The contractors for paving and for building sewers are paid in cash weekly. Funds for these pavements are provided by issuing city bonds, having five years to run, the amount to be issued in any year and the total amount outstanding being limited by the terms of the city charter. Upon the completion of the season's work, the total cost of each improvement, either in paving or sewer construction, is estimated by the Board of Public Works, and by them assessed upon the property benefited. This assessment, after being ratified by the council, is turned over to the City Assessor, who divides the total assessment upon each lot into five parts, one-fifth of the total assessment, with interest on the remaining four-fifths is placed in the coming tax-roll, and collected with other taxes. The next year another fifth, with interest on the remaining three-fifths, is assessed and collected in the same manner. By this method the property owners need pay only a small portion of the entire cost at once, and the burden of expensive improvements is lightened. Consequently, petitions for sewers or paving are numerous, and the council is compelled each year to select from the number those cases which are of the most immediate importance. If the whole cost of such improvements were demanded at once, it is probable that petitions would be rare and remonstrances numerous. All public improvements are done under the direction of a Board of Public Works, composed of five members, one of whom goes out of office each year. This Board is appointed by the Mayor, and the members serve without pay. The Board appoints the City Engineer and Superintendent of Streets. It should be added that the city at large pays for the cost of paving or grading all street intersections, and also pays for the excessive cost of large sewers. In estimating the amount to be assessed upon the property for building a sewer, the Board computes what would have been the cost of a 12-in. pipe sewer for the distance in question, and this amount is assessed upon the property, the balance being paid for by the city at large. By this method the city of East Saginaw is enabled to have its public improvements made at the lowest prices, and it compares well with any city in the United States in point of condition of streets and sanitary improvements.

There may be other cities having equally good methods but to the writer the East Saginaw way seemed to be unique and deserving imitation.

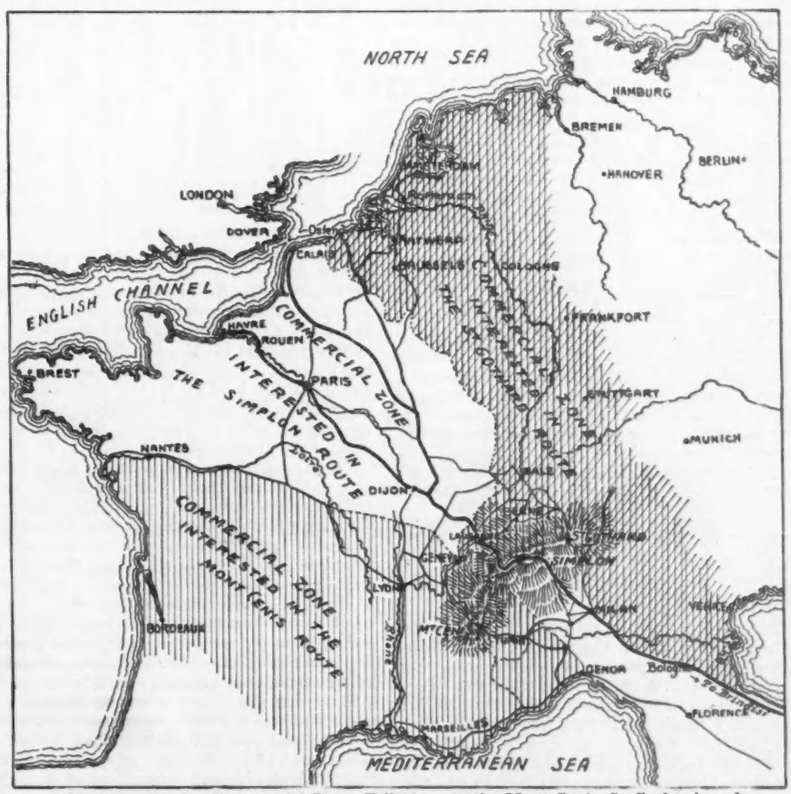
THE following from a contemporary may help some who are interesting themselves about terms and definitions. A railway sleeper is not often defined at length: "A sleeper is one who sleeps. A sleeper is that in which the sleeper sleeps. A sleeper is that on which the sleeper which carries the sleeper while he sleeps runs. Therefore, while the sleeper sleeps in the sleeper the sleeper carries the sleeper over the sleeper under the sleeper until the sleeper which carries the sleeper jumps off the sleeper and wakes the sleeper in the sleeper by striking the sleeper under the sleeper, and there is no longer any sleeper sleeping in the sleeper on the sleeper."

THAT the late flurry in Wall street, with its almost unprecedented drop of two or three leading and high-priced stocks, did not result in more serious consequences is a pretty good sign that the time is not yet very near for "the bottom to drop out of everything." It was of course an artificial and intended flurry manufactured to grind private axes, but when the time is ripe for the trouble to begin, a less cause than this one may well suffice to start it.

The Proposed Simplon Tunnel.*

The chain of the Alps which separates the Italian peninsula from Central Europe covers an area of about 600 miles in length by 90 to 120 miles in width. This mountain mass is crossed in several places by railways. At the eastern extremity is the line from Vienna to Trieste, across the Norique Alps, placing Austria in communication with the Adriatic. In the Tyrol is the Brenner railway running from Verona towards Munich and thence to Berlin and Vienna. The St. Gothard line pierces the central mass of the Swiss Alps and connects Italy and Germany. And finally there is the Mont-Cenis railway which directly unites France and Piedmont.

It is a well known fact that the opening of the St. Gothard line had a very prejudicial effect upon French commercial interests as it has diverted the traffic from the East that at one time had but the



Map showing the Commercial Zones Tributary to the Mont Cenis, St. Gothard, and proposed Simplon Tunnels.

choice between the Mediterranean line by way of Marseilles or by the Mont-Cenis tunnel. This latter tunnel route can not compete with the St. Gothard.

As far back as 1870, when Germany, Italy and Switzerland united in inaugurating the St. Gothard tunnel, the legislative body of France attempted to pass a law which had for its end the tunnelling of the Simplon. And the chief reason given for this action was that the opening of the Suez canal had greatly modified the conditions of transit between Europe and the extreme East, and that the several nations were combining to draw into their own territory the increased commercial movement that was likely to result from this new route. While the French recognized the importance of prompt action on their part, the Franco-German war put an end to the enterprise for the time being. The Simplon plan was again broached in 1873 and 1880, but a question between the relative merits of this plan and another line proposed *via* Mont Blanc again checked the project. The Swiss government is now actively interested in this Simplon line and is rapidly awakening interest in France.

Le Genié Civil presents a tabulation of the various projects for crossing the Alps at this point; these projects dating back as far as 1800, when a "national road" to Italy was under discussion. The first tunnel projected was in 1857, when a length of 12,200 metres was suggested. Since then some twenty-three plans have been presented, the last being sent in by Engineers FELL and AGUDIO in 1886. Each of these gentlemen have alternative plans varying in tunnel length from 4,000 to 10,000 metres, and in cost from 16,000,000 to 40,000,000 francs. Another project of 1886, revised by a board of experts, would give a tunnel 16,070 metres long that would cost over 52,000,000 francs for single track and over 62,000,000 francs for double-track.

The detailed history of the late activity in this direction is about as follows: Towards the end of 1885 the five western cantons of Switzerland began to show a high degrees of interest in the tunneling of the Simplon, and to give a decisive impulse to this important enterprise they set about raising the necessary capital. On March 22, 1886, delegates of the cantons of Geneva, Vaud, Neuchatel, Fribourg and Valais, of the Suisse-Occidentale-Simplon railway company, and of the New Bank of Swiss Railways united in a conference at Lausanne and nominated a commission of experts made up of engineers of various countries. The programme submitted to this commission was to study the several projects submitted for piercing the Simplon both from a practical and a comparative standpoint, and to submit modifications that might reduce the cost without interfering with the efficiency of the plans.

This commission of experts included ERNEST POLONCEAU, Chief Engineer of maintenance of way of the Orleans railroad, DOPPLER, Chief Inspector of the imperial and royal Austrian railways, W. HUBER, Civil Engineer of Paris, and J. DUMUR, Civil Engineer of Lausanne. Their report was published on Nov. 17, 1886, and embodied the following recommendations:—First, to make plain the geographical situation of the proposed Simplon project and its commercial importance when compared with the St. Gothard and Mont-Cenis routes, they presented the map, shown herewith, with the several areas or zones naturally tributary to each Alpine route marked out upon it. In presenting this map the commission stated that there was no certain rule by which the dividing line between two commercial currents could be laid down with precision, owing to the circumstances of the individual preference of travellers or shippers, difference in rates or time of transport, custom formalities, nation-

*Abstract of articles in "Le Genie Civil," of May 28, June 4, 1887.

ality, etc. But they based their map upon a comparative table showing the actual distances across the Alps between various important commercial centers by the three mountain routes.

The commission then examined the plans of Engineers FELL and AGUDIO, and that of the *Societé Cail*. They concluded that these projects should be at once rejected, as they each contemplated transshipment and changes of system that were absolutely inadmissible in a line of through transit, such as the situation required. The FELL system has been known for a long time and was applied for some years at the Mont-Cenis tunnel during its construction, but with no very gratifying results. The plan of M. AGUDIO divided the line between Brigue and Gondo into four sections of 6 kilometres each, which were to be worked independently of each other with a change of goods and passengers at each section terminus; it practically meant a succession of cable railways. M. AGUDIO put his maximum grade at 14 per cent.; used curves of a minimum radius of 250 metres, and employed two cables instead of one. By his plan 2h. 40m. would be consumed in going this 24 kilometres, or about 15 miles. His estimate of cost was 20,000,000 francs and the whole scheme was elaborately worked out.

The commission unanimously advised against this plan both for the reasons before given and because that for eight months in the year the traveller would doubtless prefer the comfortable sleeping car of the St. Gothard route. The *Societé Cail* offered for 39,000,000 francs, to charge itself with the execution of the Simplon project, leaving to the *Suisse-Occidentale-Simplon* R. R. Co., however, the purchase of lands, construction of the depots and the fencing. The commission in discussing this plan thought that the tunnel-work proposed would be very costly, and that no provision had been made for lining which would be absolutely necessary and add greatly to the total expense: the motor suggested presented difficulties in working the road and the 112 cars per day proposed was absolutely insufficient for the service and bore no proper relation to the great outlay. Accidents by derailment would also be almost inevitable and the system was dangerous as well as insufficient for the demands of traffic. It was therefore rejected.

[TO BE CONTINUED].

Stand Pipes.

Mr. A. H. HOWLAND, in a paper published in the last Proceedings of the Engineer's Club of Philadelphia, speaks practically as follows concerning the construction of stand pipes for water works:—

Circumstances of location and cost must determine whether it is better to build the iron cylinder from the ground or to support it upon some type of elevated structure. The thickness of material in the sides of stand pipes can be determined by the formula

$$\frac{R \times H}{S \times P} \times F = T \text{ in which } R = \text{radius in inches;}$$

H = height reduced to pounds pressure; T = thickness; S = theoretical tensile strength of material; P = per cent of strength of whole sheet to the riveted joint and F = factor of safety.

It is now possible to obtain iron having a tensile strength of 50,000 lbs. per sq. in. of section. And in recent experiments by the U. S. Government it has been determined that properly proportioned double riveted seams possess 75 per cent. of the strength of the solid sheet, and single riveted joints 66 per cent. These figures can be taken as the value of P. The factor of safety depends upon proportions and situation; a pipe of large diameter and exposed position should have a larger factor than a pipe of small diameter well protected. It is never safe to use a less factor than 3, and the author has adopted 4 in his practice.

Under these conditions a stand pipe 25 ft. in diameter and 100 ft. high should have a thickness of 0.694 in. in the bottom plates and gradually decrease towards the top. The formula given literally followed would reduce the thickness below practical limits and so the author has prepared a table for his own guidance as follows:—

It is feasible to obtain sheets that will "build" five feet each, and he has so assumed in these tables. The decimals of an inch can be transferred into the nearest vulgar fractions, or wire gauge, by the use of the tables. Many mills are now rolling sheets by decimals rather than any other standard.

STAND PIPES.

Tensile Strength of Material, 50,000 lbs. per sq. in. Horizontal Seams Single Riveted. Vertical Seams both Single and Double Riveted. Double Riveted Seams, 75 per cent. as strong as the whole sheet. Single Riveted Seams, 66 per cent. as strong. Factor of Safety, 4. Each Sheet to build 5 ft.

Diameter.	Gallons per foot in depth.	Minimum thickness for top.	Distance from top to carry minimum thickness.	Distance from top to carry single rivets.	Constant to add to min. thickness for each 5 ft. below dist. given in 5th col.
Ft.		Ins.	Ft.	Ft.	Ins.
5	147.0	0.1455	105	65	.0069
6	211.5	0.1494	90	55	.0083
7	287.9	0.1455	75	50	.0097
8	376.0	0.1554	70	45	.0111
9	475.9	0.1500	60	40	.0125
10	587.5	0.1525	55	35	.0139
12	846.1	0.1670	50	30	.0167
14	1,151.5	0.1940	50	30	.0194
15	1,325.9	0.2080	50	30	.0208
16	1,504.0	0.1989	45	25	.0221
18	1,903.6	0.2192	40	25	.0249
20	2,350.0	0.2218	40	25	.0277
22	2,843.5	0.2440	40	25	.0305
25	3,672.0	0.2425	35	20	.0347
27½	4,442.7	0.2681	35	20	.0383
30	5,304.0	0.2496	30	20	.0418
33	6,398.2	0.2754	30	20	.0459
35	7,197.0	0.2917	30	15	.0486
40	9,400.0	0.3332	30	15	.0555
45	11,897.0	0.3127	25	10	.0625
50	14,688.0	0.3465	25	10	.0693

Weight can be obtained as follows:—Figure the superficial area of the stand-pipe of given diameter for five feet in height, multiply this by the weight of a square foot of metal of the thickness of each ring, and them all together and to the weight of the bottom, and then add 10 per cent. for laps and rivets; this being an average amount for this class of work. The result will be the weight of the whole, and the cost can be approximated by multiplying this weight by six cents, as an average price per pound for such work at the present time.

As the bottom of a stand-pipe, when properly supported by the foundation, is subjected to compressive strains only, its thickness need be no greater than is required for thorough riveting and caulking. In pipes of small diameter ⅜ in. is enough and ¼ in. thickness is sufficient for the largest diameters. In joining the sides to the bottom the author preferred to have the bottom extend beyond the sides and an outside angle-iron used double-riveted to both sides and bottom. A plentiful use of cement and paint on the inside will prevent the percolation of water between the plates and around the rivets.

In riveting the sides it is best to have each ring slightly conical so that the upper edge, which is the most natural one to caulk will come inside. The joints should be thoroughly chipped and caulked. "Split-caulking" can not be depended up. Rivets should be large and thoroughly headed down.

The top of the foundation should be level and covered with hydraulic cement or asphaltum before the base of the pipe is set upon it. After being lowered into place the upper edges of the bottom seams should be re-caulked as they are liable to be strained in being set. To prevent rust, both the outer and inner surfaces should be thoroughly coated with red-lead and then with asphaltum, mineral or lead-paint.

Stand-pipes of small diameter and extreme height must be guyed and anchored. And all stand-pipes should be made secure against a wind-pressure of 50 miles per hour when empty.

Accidents in Shafts.

The Iron and Coal Trades Review, for May 20, gives a tabular statement of loss of life from shaft accidents in English mines for the period 1851–1886, showing that in these 36 years 5,552 lives were so lost. In this time the coal production has about trebled and the number of mines doubled and the mortality per 1,000, by shaft accidents, has decreased from 1.02 in 1851 to 0.16 in 1886. The total mortality has likewise decreased from 4.56 per 1,000 in 1851 to 1.83 in 1886.

In the decade 1851–61, there were 2,119 shaft deaths, or 21.2 per cent. of the deaths from all accidents. In 1861–70, the shaft deaths were 1,505, or 14.2 per cent. of total deaths from accident and 0.47 per 1,000 in annual mortality. In 1871–80 the shaft deaths were 1,355, or 11.9 per cent. of total and 0.28 per 1,000 in the year. In the six years 1880–86, there were 573 deaths from this cause, or 9.3 per cent. of total accidental deaths and an annual mortality of 0.19 per 1,000. The passage of the Coal Mines Regulation Act in 1872 reduced the shaft deaths from 0.61 to 0.23 per 1,000, or from 17.1 to 10.7 per cent. of total deaths.

The chief causes of death in the shaft were as follows and in the order given as regards frequency of accidents:—(1) Falling from part way down; (2) ascending or descending by machinery; (3) falling into shaft from surface; (4) things falling from part way down; (5) ropes and chains breaking; (6) things falling from surface; (7) overwinding. In the period noted the accidents of the second-class above have only decreased 13 per cent., and it is evident that more efficient means are required by which men riding in the cage can signal to the engineman. To this end Mr. W. ARMSTRONG, the manager of the Wingate Grange Colliery, has lately devised a method by which an electric wire is conducted down the core of the winding rope, and signals can be instantly given by pressing a knob in the top of the cage.

Explosives by Reaction.

Explosives by reactions are mixtures of material not in themselves explosive, but which in certain conditions and under the influence of considerable molecular shock, can be transformed into explosive agents in which detonation immediately follows the combination.

That the effect may be instantaneous it is necessary to distinguish between the two consecutive phazes: 1st. The mixture is transformed into one or more explosive agents. 2nd. The explosives, so created, detonate: If, for example, we bring glycerine into contact with a body that can furnish, by decomposition, nitric acid, nitro-glycerine results, which in its turn can be decomposed and cause an explosion.

In the same manner we can treat fulmi-coton, nitrobenzine, nitromannite and in general all the explosive nitres. The initial reaction is produced by some manner of priming, or a detonator; but it is essential that this priming produce a violent breaking effect and that it can be simply fired.

The use of explosives of this nature is most advantageous in mining operations, as the materials can be transported and charged without danger. The first explosives of this class date back to 1875, and are known under the name of SPRENGEL explosives. These were made up of carburet of hydrogen, nitrates, sulphates or carbonates, impregnated with nitric acid or peroxide of azote. Some of these mixtures, in which the hydrocarburet elements and nitre are simply placed in juxtaposition, detonate with great violence when fired by a detonator of fulminate of mercury. In the open air, on the other hand, they quietly burn when brought into contact with fire. The *panclastite* of Mr. TURPIN belongs to this class of explosives.

But these mixtures cannot be prepared in advance owing to the oxydizing properties of the nitric acid and the difficulties presented in their manipulation; and furthermore they lack stability. There is then little chance of there becoming a substitute for dynamite, at least, under this form and present conditions.

The more recent explosives by reaction known as *asphaline* (1882) and *polynitrocellulose* (1884), show notable progress, though their composition is somewhat complex.

Polynitrocellulose was patented in 1884 by M. LUCIEN HEUSSCHEN. According to the Swedish patent it is made as follows:

Nitrate of Potash	65 to 93.20
Sulphur	12
Lampblack	3
Tan-bark	20 to 25
Sulphate of Iron	1.40 to 27.80
Glycerine	0.92 to 1.84

Under the shock of the detonation of a capsule of fulminate, the nitric acid is set free from the nitrate and forms a nitro-cellulose, which decomposes in turn and brings about an explosion. According to the dosage in weight of the saltpetre entering into the mixture, the nitro-cellulose resulting from the successive reactions may include 1, 2, 3—or even 10 equivalents of nitric acid. Its manufacture is very

simple. The different elements are pulverized and a small quantity of water added; it is then dried at 110° or 120° C, and the product appears as a fine powder that is worked up with the glycerine. The compound is inalterable in the air and is used in the form of compressed cartridges. This cartridge is put into the drill-hole and fired by a detonator and a Bickford match. The product is absolutely harmless and can be handled with impunity.

Asphaline.—In this compound nitro-glycerine is formed, as shown in the following formula:—

Bisulphate of potash. Nitrate of potash or of soda }	4 to 27
Bran or sawdust	42 to 32
Chlorate of potash	54 to 41
Hydrocarburet.	
Glycerine.	

This mixture can be fired with a simple Bickford match, without a detonator. The priming required to bring about the necessary molecular shock lies in this case in the chlorate of potash. The series and order of reactions produced are as follows:

1st. The direct inflammation of the chlorate of potash:

$$K O, Cl O^5 = K Cl + O^5$$

2nd. The disengagement of the nitric acid by the action of the bisulphate of potash upon the nitrate of soda:

3rd. The formation of nitro-glycerine:

$$C^6 H^8 O^9 + 3 (Az O^6 H) = C^6 H^5 (Az O^6 H)^3 + 6 H O.$$

4th. The decomposition and explosion of the nitro-glycerine:

$$C^6 H^5 (Az O^6 H)^3 = 6 C O^2 + 5 H O + Az + O$$

The excess of oxygen which results from the double decomposition of the chlorate and the nitro-glycerine is utilized in burning the carbon in the carbonaceous matter and transforming it into carbonic acid. All these reactions are subsequent, but the effect is instantaneous. To prepare this *asphaline*, all the salts are intimately mixed with the carbonaceous matter by adding a little water. Then it is dried and finally mixed with the glycerine, which should first be absorbed by the bran. The mass thus obtained is made into compressed cartridges.

The bran used is from wheat or barley, well dried and without any flour. The quantity of glycerine to be introduced into the mixture, is determined according to the weight of the nitric acid formed by the decomposition of the nitrate. By varying the dose, a product can be obtained finally producing more or less nitro-glycerine, and consequently an explosive more or less energetic.—*Le Genie Civil*, May 7, 1887.

The American Dredgers at Panama.

The accompanying illustration, taken from a photograph, shows one of the seven dredges of the American Contracting and Dredging Co., of New York, at work on the Panama canal. Thanks to the energy of Mr. H. B. SLAVEN, the president and active business manager of the company, more than one-third of total cube extracted on the line of the canal, must be credited to this American enterprise; and this in the face of a competing array of what were at least sold as the best English and European dredgers and excavators. In our issue of Feb. 3, 1883, will be found a detailed description and full illustrations of the "Hercules" dredge, the first one of the seven built.

We can not say whether or not this is one of the dredges referred to in our late notes on the Panama canal, which was described as standing in one spot and simply rehandling the material forced up from the bottom by the weight of the excavated material on the banks. But as this is a particularly "healthy" dredger, being able to handle about 15,000 cu. yds. in a day of ten hours, we believe it would be very likely to dig itself out of even a tropical swamp.

A REMARKABLE new printing press capable of printing 60,000 copies per hour of either a four or six-page paper, and 30,000 copies per hour of either an eight, ten, or twelve-page paper has just been built by Messrs. R. HOE & Co. for the *Mail and Express* of this city. In each case the papers are delivered in sets pasted and folded. To do this at the rate of 1,000 copies per minute from a single machine of extraordinary size is certainly a most wonderful achievement, and nearly twice as much as has been heretofore possible.

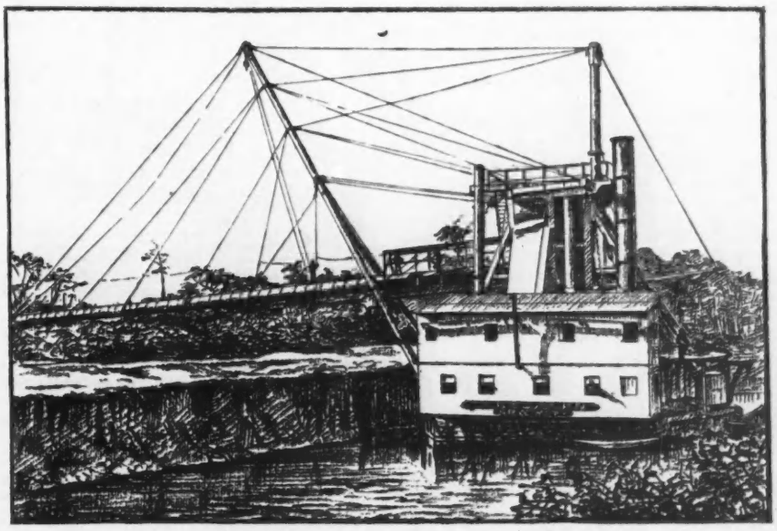
The New Method of Dimensioning.—A Criticism.

EDITOR ENGINEERING NEWS:

The three articles by Mr. ALFRED D. OTTEWELL on "The New Method of Dimensioning," that have recently appeared in your paper, have doubtless been read with great interest by many engineers, and I take pleasure in acknowledging my debt to Mr. OTTEWELL, for the clear and succinct manner in which the subject has been presented.

Yet I wish to take exception to one conclusion at which he arrives, which to me hardly appears justified by the condition of the case.

Formula (*A*), for determining the unit working stress under variations of loading, is, as he states, identical with LAUNHARDT'S well known formula, but Mr. OTTEWELL claims for it an entirely independent deduction, based on entirely independent observations from those used by LAUNHARDT, and



Dredge of the American Contracting and Dredging Co. at work at Panama.

educes from the coincidence of the two formulæ an additional proof of the correctness of their use in dimensioning. It is to the correctness of these claims, and the value of the endorsement of the method which he finds therein, that I wish to take exception, and in doing so assert nothing regarding the correctness, or otherwise, of the use of LAUNHARDT'S formula in dimensioning. I quote from your issue of May 21, 1887, p. 330:

"Referring to formula (*A*), and formulæ claiming to be based on the experiments of WÖHLER and SPANGENBURG, such as the formulæ of LAUNHARDT, WEYRAUCH, CAIN, and others; it has been asserted that WÖHLER'S experiments do not justify the superstructure that is being erected upon them. Such an assertion, however, does not apply to formula (*A*), since this formula was derived without any reference whatever to the experiments of WÖHLER and SPANGENBURG, and up to this point the writer of this article has purposely omitted any reference to these experimenters, lest he should be misunderstood."

"Without assuming therefore, anything more than three facts agreed on by practical engineers, formula (*A*) has been deduced; and the fact that it takes the same form as formulæ deduced from the experiments of WÖHLER and SPANGENBURG simply adds weight to its value, and shows these experiments to be in harmony with general experience."

The statement of my case is, that so far as is made apparent by a comparison of the method used by Mr. OTTEWELL, with that used by LAUNHARDT, as given by WEYRAUCH in his "Iron and Steel Construction," I gather:

1st. That "the three facts agreed on by practical engineers," as employed by Mr. OTTEWELL, and the experiments of WÖHLER and WÖHLER'S law expressing them, used by LAUNHARDT, are practically identical.

2nd. Mr. OTTEWELL appears to take for granted an addition to the three observations on which he states formula (*A*) is based, and that is, a law of change of the working stress *a*.

On looking for a similar assumption on the part of LAUNHARDT, I can only find the value of *a* definitely stated by formula for the two extremes of all dead load, when $a = t$, and all live load, when $a = u$.

For intermediate values he depends on experiments to prove the truth of the formula, and gives a series of experiments to show that it holds true for them.

With due regard for the excellence of Mr. OTTEWELL'S work, I cannot see that his method of development of this particular formula (*A*) is fully justified by the observation which he states are the basis of it, and hence cannot feel that it is as scientific as LAUNHARDT'S method, although the formula itself is the same.

3rd. The two formulæ are founded upon essentially the same assumptions, and this I say, fully realizing that Mr. OTTEWELL assumes a law of change for *a*, which LAUNHARDT does not.

The fact, however, that this law can be proved true for only the two extreme cases of $a = t$, and $a = u$, removes it from the class of general assumption on which a general formula can be based, and gives it rank only, with analogous mathematical manipulation that LAUNHARDT employs. The aim has been in both formulæ to get an expression for *a* in terms of *t* and *u*. They employ the same symbols. The formulæ are both mathematically correct for the two limiting cases, giving the two extreme values of *a*.

If all this is true, the two formulæ must, of necessity be identical. Both start with the same hypotheses, and the fact of their reaching the same conclusion does not prevaricate anything of the correctness of the hypotheses: they simply check each others use of the algebra.

Therefore the use of these formulæ in dimensioning gains no additional sanction from the mere fact of their being identical.

A brief statement of the methods used in deducing each formula will show the grounds on which my opinions are based. For the purpose of comparison I will so far as possible arrange the deductions of both writers, written or implied, on the same scheme, and transposed into the same notation.

The notation is as follows:

A and *a* are respectively the total and the unit safe working stress under assumed conditions.
T and *t* are the corresponding symbols for all dead load.
U and *u* are the corresponding symbols for all live load.
Max. B. = *M*, is the greatest stress upon the member, whether tension or compression.
Min. B. = *m*, in the least stress of the same kind as *Max. B.*

Mr. OTTEWELL states that formula (*A*) is derived from the three following practical observations agreed upon by practical engineers.

1. The injurious effect of a live load upon any member of a bridge is much greater than the injurious effect of a dead load of the same amount.
2. If the member is one of the wrought-iron tension

bars of a railroad bridge, the iron being to standard specification, the allowable unit stress t, for a dead load, should be 15,00 lbs. per sq. in.

3. If however, the load is entirely a live load, and always produces the same kind of stress, tension or compression, the allowable unit stress u, before considering it as a column, if in compression, should be 5000 lbs. per sq. in.

From these observations he deduces that $a = a$ function of $(M - m)$

He then assumes on the strength of the observations, and on the fact that the additional part of the load due to live load $= M - m$, that the law of variation is, that a is an average of t with a varying weight of the quantity u, the weight varying directly as the ratio $\frac{M-m}{m}$

Hence, the formula $a = \frac{t + \frac{M-m}{m} u}{1 + \frac{M-m}{m}}$

A test of the formula will show that the assumed law of variation is correct for the extremes of all dead load, when $M - m = 0$ and $a = t$, and all live load, when $m = 0$ and $a = u$.

Only experiments can prove it for immediate conditions of loading and values of a.

The formula reduces to

$$a = u\left(1 + \frac{t-u}{u}\,\frac{Min.\ B}{Max.\ B}\right) \quad \text{(Formula } A\text{)}$$

LAUNHARDT begins with a statement that is essentially the same as Mr. OTTEWELL'S observations 2 and 3. In it he deals with ultimate instead of working stresses, but he recognizes the existence of a certain allowable unit stress t, for all dead load, and another allowable unit stress u, less than t, for all live load.

He then states that "by WÖHLER'S law, A decreases as $M - m$ increases," which remark covers essentially Mr. OTTEWELL'S first observations. He then obtains, A = a function of $(M - m) = a$ $(M - m)$. The values of A for the following two extreme are definite. For all dead load, $M - m = 0$, and $A = T$. For all live load, $m = 0$, and $A = M - m - U$. The equasion shows: For $M - m = 0$, since $A = T$, $a = \infty$. For $M - m = U$, since $A = U$, $a = 1$. Taking $a = \frac{T-U}{T-A}$, it will satisfy these conditions for the two extreme cases of all dead load, and all live load, and hence, $A = \frac{T-U}{T-A}(M - m)$ is correct for those two cases. LAUNHARDT states that whether it is correct for intermediate conditions of loading remains for experiment to prove.

The equation reduces to the form

$$A = U\left(1 + \frac{T-U}{U}\,\frac{m}{A}\right)$$

Divide through by the area of cross-sections, and

$$a = u\left(1 + \frac{t-u}{u}\,\frac{Min.\ B}{Max.\ B}\right) \quad \text{(Launhardt's formula)}$$

A comparison of these synopses of the methods used by the two writers substantiates, if I am not mistaken, the criticisms already made of Mr. OTTEWELL'S claims and methods of deducing formula (A).

He states from the same basis as LAUNHARDT. He assumes a general law, which I fail to see that his fundamental observations justify. This law being true, however, for the two limiting values, where from the nature of the case, $a = t$, or $a = u$, places it in the same line with certain mathematical manipulations employed by LAUNHARDT.

The two writers both make $a =$ a function of $M - m$, and get an expression for that function in terms of t and u.

Hence the two formulæ are necessarily identical, and the mere fact of their being so proves nothing of the correctness of the assumption on which they are based, and does nothing to endorse the use of them in dimensioning.

Before closing allow me to call attention to a comparison that can be made between Mr. OTTEWELL'S formulæ and diagram for working stress in columns, and an article on the subject of columns read before the American Society of Civil Engineers by Mr. THOS. H. JOHNSON, and published in their Transactions, Vol. 15, p. 517.

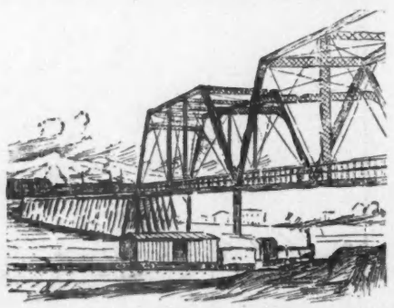
Mr. JOHNSON employs a curve whose equation is EULER'S equation, for long length ratios of $\frac{l}{r}$, and beyond a certain point changes the equation to that of a straight line, for short length ratios of $\frac{l}{r}$.

Mr. OTTEWELL employs a straight line for his curve throughout. A comparison of the diagrams and their equation is interesting.

JAMES L. GREENLEAF.

A "Good View" of a Denver Bridge.

The Twenty-third street viaduct will be completed in a few days and thrown open to travel. A viaduct to connect East and North Denver has been talked of for years, and the day it is finished will mark a new era for the thousands of people it will accommodate on the North Side. A GOOD VIEW OF THE STRUCTURE APPEARS BELOW. The City of Denver appropriated $15,000 for the via-



duct and the remainder of the money necessary was contributed by Messrs. HILL, WOLCOTT and others. In length it is about 1,50[illegible] ft. and crosses the Platte River, and intervening bottoms at a good elevation. It has sufficient width to accommodate a streetcar track and still give room for vehicles.—*Denver Republican.*

Effect of Freezing on Cement Mortar.

Mr. ALFRED NOBLE, M. Am. Soc. C. E., in a short paper on the effect of freezing on cement-mortar, says that in constructing a lock at the St. Mary's Falls canal, mortars of Portland cement and a good quality of American natural cement were used in adjoining parts of the work, with 1 cement to 1 sand in each. In the following spring the Portland cement mortar was perfect, showing on its surface the marks of the rain falling when it was laid, while the natural cement was disintegrated to a depth of 3 or 4 ins. In the same locality he used, in extremely cold weather, a Portland cement mortar, in making concrete. Salt was used freely but with little effect in retarding the freezing. Samples of the frozen mortar set properly after being put in a warm place and in the work there was no settlement of the masonry and in a few months it sustained a pressure of 15 ft. of water without showing leaks.

In building some piers for the Northern Pacific R. R., near Duluth, in the winter of 1884-85, the temperature varied from 0 to 20° while building Pier 1; while building Pier 2 it was about 20° higher and while at work on 3 and 4 it was occasionally above the freezing point. Portland cement was used throughout, with 1 cement to 1½ sand for face-stone and 1 to 2½ for backing. In the extremely cold weather salt was used freely in the mortar and the sand warmed (not made hot), but with the thermometer at 20° the mortar froze so quickly after being spread upon the stone that if a better bedding was required the stone had to be raised, the frozen mortar scraped off and a new bed made. When milder weather had set in an examination showed no difference in the quality of the mortar laid in the coldest weather embraced in the period of construction.

Mr. NOBLE also gave the results of some experiments on the freezing of Portland cement mortar containing varying amounts of salt. The mortar was made with 35-oz. cement to 7 oz. of water. With no salt the tensile strength per sq. in. at the end of seven days immersion in test-room was 327 lbs.; the same frozen three days and immersed four days, was 316 lbs. With 1 oz. of salt, unfrozen, the seven days test gave 402 lbs.; frozen three days and immersed four days, it gave 409 lbs. The salt dosage ranged from ⅛-oz. to 1-oz.: ½-oz. gave the highest results, or 429 lbs. unfrozen and 415 lbs. frozen three days.

To study the effect of mixing salt with Portland cement mortar, he used a mortar mixed by weight with 21-oz. cement, 23-oz. sand and 6-oz. of water. With no salt this mortar in seven days gave a tensile test of 155 lbs.; in six months, 311 lbs.; in one year, 382 lbs. and in two years 430 lbs. With ⅛-oz. of salt the test for the same periods was—139, 288, 264 and 346 lbs. respectively; with ¼-oz. salt they were—139 289, 388 and 326 lbs.; with 1-oz. salt they were—128, 288, 309 and 334 lbs. per sq. in.

On a New Method of Making Tubes from Solid Bars.*

BY GEO. H. BABCOCK, NEW YORK CITY.

We have all heard of the Irishman's method of making a cannon by "taking a hole and pouring melted iron around it," but it has been reserved for a German actually to do a similar, or apparently, an even more difficult thing—to take a hole and force a bar of wrought-iron or steel around it! We are familiar with the process of drilling and punching for perforating metals, but here comes a man who, ignoring all such makeshifts, by "external applications only"—as a skillful physician treats an internal congestion—rolls a hole into the middle of a solid rod, thus forming it into a tube! What makes the hole? Apparently, like the boy's whistle, it "does itself."

Seriously this is no joke. The specimens which I have the privilege of exhibiting to the Society, tell their own story, and scarcely need the evidence of the eye witness who saw them made, and who loaned them for this purpose. As yet the process has not been worked in this country, but it is in practical operation in Germany. It is the invention of two brothers named MANNESMANN, of Remscheid, and the *modus operandi* is as difficult to understand and explain, as was GIFFORD'S injector, or BOHNENBERGER'S gyroscope.

The apparatus necessary to effect the result, consists of two rollers slightly conical, the axes of which are in different planes—or form two lines in a twisted surface—their nearest approach being at or near the bases of the cones. The surface of the cones may be threaded in such a way that they tend to draw a body rolling between them towards their larger ends. The bar to be operated upon should be approximately round, and its end to be inserted while hot, between the cones, its axis being intermediate at all points to the axes of the rollers. The action of the cones is to draw out and twist the bar, during which operation a hollow forms in its axis, and when the bar emerges, it is a tube with a somewhat rough but approximately cylindrical and concentric bore, the surface of which shows a decided twist.

Among the exhibits is a bar which was drawn down at each end before going through the mill, so so that no action took place at these ends. This bar, after cooling, was broken, and shows conclusively by the color and character of the bore, that no tool and not even the air touched it during the operation, the interior having the same appearance as the fracture.

The tubes thus formed, are applicable directly for some purposes, but by a proper formation of the rolls behind the bases of the cones, or additional pairs of rolls, with suitable mandrel or mandrels, this tube may, at the same heat, be expanded and finished into a regular weldless boiler tube, or gas pipe, as some of the specimens shown; or this may be done at a separate operation.

That the metal is not harmed by this rather rough handling may be inferred from several specimens shown of tubes which have undergone operations of expanding, flanging, flattening, etc., which would try the temper and quality of any respectable tube. Specimens are are also shown of brass and copper tubes, made by the same process.

The Burlington Artesian Well Association has been incorporated at Burlington, Ia., with a capital stock of $15,000.

*Transactions of the American Society of Mechanical Engineers.

Average Results, Burlington Freight Brake Tests, 1887.

DISTANCES CORRECTED FOR SPEED AND GRADE. EMERGENCY STOPS.

NOTE.—The distances corrected for the exact speed noted and for level grade. [From the Committee's Official Report.]

KIND OF STOP.	No. OF STOPS.	NAME OF BRAKE	Speed.	Distance.	TIME. Fr'm brake applied by engineer. Rear car. Brakes begin to apply.	Brakes fully on	From full stop. Brakes off rear car.	Train moving	From release signal till full release, rear car.	No. of cars released by hand.	TRAIN. Total weight engine, cars and load.	Per cent. braked.	PRESSURES. Before stop, train pipe	Cylinder, rear car.	Brake beam pressure, per cent. weight empty car.	Slideometer movement, rear car.	Couplings broken.	MISCELLANEOUS. Brake casualties.	Wheels slid, distance.
			Mls	Ft.	Sec.	Sec.	Sec.	Sec.			Tons		Lbs.	Lbs.		Inches.			Ft.
Fifty Empty, air.	511-521	Westinghouse.	20	214	5	.....	14½	34	.....	1	855	93.4	73½	.....	.....	70⅝-103	1	.....	30
	522		40	693	6	.....	.....	.....	.....		846	95.0	73	.....	.....	70½	1	.....	
	711-724	Eames.	20	300	11	.....	19½	54¾	19	1	741	94.5	20"	12"	91.4	18½-23½	....	.....	230
	641-644		40	910	11	17½	19½	107	19¾	....	742	94.5	19"	10½"	91.7	15⅞-23¾	....	.....	
Fifty Empty, electric.	751-824	Carpenter.	20	111	1½	4	1½	73	1½	2	766	95.1	64	33½	98.5	.....	....	.....	5
			40	450	1½	4½	2	69	1¼		766	95.1	61	37½	100.0	.....	....	.....	
	531-614	Westinghouse.	20	136	½	3½	36	140	33½	1	846	95.0	73	.....	.....	.....	....	.....	7
			40	505	½	3½	40½	106½	39½	.....	846	95.0	75½	.....	.....	.....	....	.....	
	731-4	Eames.	20	258	3	9	16¼	287	15½	.....	729	95.0	20"	10½"	.....	12½" stop.	1	Dynamo and electric appliances gave considerable trouble, finally necessitating giving up a run.	180
	911-4		40	614	2¾	7	8	82	8	6	729	95.0	19½	10½	.....	913			
Fifty Mixed, electric.	941-1014	Carpenter.	20	169	1	3½	1	124	⅞	6	1465	45.3	69	38	106.7	¼" to ¾"	....	Four cars cut out for defects in release valves, and one on account of broken brake rod	160
			30	442	1	4	1½	113	1¾		1465	45.3	65	37	97.4	0" to ½"	....		
	1111-1124	Westinghouse.	20	183	½	3½	69½	152¼	57½	2	1641	49.3	82	60½	.....	.....	....	.....	10
			30	438	½	4	79¾	459¾	74		1641	49.3	82	61	.....	.....	....	.....	
	1311-1314	Eames.	20	242	1½	6¾	8¼	97	.....	.....	1389	49.1	20½	12	92.5	.....	....	.....	200
	1241-1244		30	516	2½	7¾	14	154½	12	.....	1389	49.1	20	11	97.8	.....	....	.....	
50 Mixed Slack Shoes.	El'c'ric	941-1014	Carpenter.	20	183	1	3½	8	461	7¾	Several.	1480	48.6	81	43½	129.2	0" to 3½"	....	Electricity failed when first started on run, owi'g to careless connection on eng. A br'ke rod & a br'ke l'ver br'ke	175
				30	334	1	4¾	8	168¾	8		1480	48.6	74	48¾	119.2	2¼	..		
		1351	Westinghouse.	20	178	¾	4½	51½	145	50	.....	1641	49.3	85	63½	.....	.....	....	.....	175
		1354		30	456	1	5	63½	161½	48½	.....	1641	49.3	83	61¼	.....	.....	....	.....	
	Air.	1431	Eames.	20	416	12	18	24¾	235½	24	.....	1399	48.8	20½	12	.....	6" to 7"	2	Two hose became uncoupled ow'ng to being too short. In 2 cars l'ad of wheels had shft'd	450
		1434		30	751	12	24	34½	576	28	.....	1399	48.8	19½	11	.....	0" to 7¾"			
Fifty Mixed, air.		1321-4	Eames.	20	407	11	15½	26¼	122¾	26	.....	1380	49.5	20½"	12"	97.6	3½ to 5½	....	.....	400
		1341-2		30	796	11	17½	33¾	177	35¾	.....	1380	49.5	19¾	11½"	98.0	2 to 7¾	....	.....	

PUBLICATIONS RECEIVED.

Trautwine's Engineer's Pocket-Book.—The twenty-seventh thousand of this standard work has made its appearance under date of March, 1887. The chief revisions of the work just issued relate to formulæ for the thickness of cylinders under internal pressure; new table of thicknesses for cast-iron pipe; additional tables of coefficient c in Kutter's formula; Mr. PEGRAM'S suggested uniform loading for railroad bridges; revised formulæ for approximate weights of latest locomotives of the latest types. The revisions and additions made to the last two or three editions of the pocket-book are so marked and of such importance that previous editions are becoming very antiquated and must be laid aside by the engineer seeking the latest data.

Straight Tips for Architects, Contractors and Real Estate Owners.—Compiled by T. H. BOORMAN, 1887. Price 25 cts. This is a third and much enlarged edition of a very useful book to have about. It contains lists of names and addresses of the architects of New York and Brooklyn, members of the Mechanics and Traders Exchange and the Mason Builders Association with the latest revisions of the Tenement House Act.

Electric Light Primer, a simple and comprehensive digest of all the most important facts connected with the running of the Dynamo and Electric Light, with precautions for Safety, etc. For the use of persons whose duty it is to look after the plant. By CHAS. L. LEVEY, 61 Broadway, New York. Price, 50 cents.

The final clause of the title of this pamphlet covers its most useful application. The introductory sections on coulombs, amperes, farads, etc., would probably leave the average dynamo attendant somewhat mixed. But the bulk of the matter relating to the service of the machine, its lamps, supplies, etc., contains material that should be very useful and well worth all it costs.

Institution of Civil Engineers.—"The Molteno Reservoir," by CHAS. JOHN WOOD. This is a detail of the failure of a reservoir at Cape Town, by reason of fissures in the undisturbed earth beneath and a description of the methods followed in repairs by the author. "Dredging Operations and Appliances," by JOHN JAS. WEBSTER, with discussion. This is a historic sketch of dredging appliances and is accompanied by much pertinent matter. The paper itself occupies about 30 pages of the Proceedings, while the very interesting and valuable discussion that follows takes up some 80 pages. Both Mr. WEBSTER'S paper and the discussions are fully illustrated, the aggregate giving every modern type of dredger.

The Industrial Situation.

The locomotive builders, car builders, rail makers and manufacturers of railway equipments and supplies have transacted within 25 per cent. as much business during the first half of this year, as they did during the entire year of 1886. The iron and steel makers have had an exceptionally prosperous half year and from all accounts they are assured of as busy a season as they have ever had. Railroad requirements are the basis of the activity; without it a panic would over take the industry. The weakest point in our industrial system is that we are building it on a ten thousand mile of railroad basis. Our rail making minimum capacity, full time is 2 000,000 tons per annum. The projected additional capacity will considerably enlarge it. This output calls for the laying of 20,000 miles of track for main line, side tracks and repairs. That output will be absorbed this year even though the construction of main line to date is only 1700 miles. A falling off in railroad building involves a falling off in all other directions. At present the rail mills and bridge and structural mills have as much work as can be done this year and it is probable they will start in January 1st with from three to four months work ahead. The bar mills are slack of work east of the mountains but nearly full in the west. The nail makers are beset with serious difficulties which they seek to avoid by attempting to form a combination to include all the nail makers in the country. The productive capacity is not far from fourteen million kegs per year, while eight million represents the maximum consumption. Several mills in the east are idle and not over one third the full capacity is at work. The plate mills have not found work enough to run full, but improving demand is in sight. Steel rails are selling at $30 to $40 per ton, for fall delivery with $28 as an inside quotation for winter delivery. Comparatively few orders have gone abroad for foreign material and American makers feel quite confident that they will be able to control the home market. Since June 1st inquiries have been received for about one hundred locomotive engines, and orders for three fourths that number have been placed. The car shops everywhere are oversold, though in a few localities, builders who are disadvantageously located are barely able to hold their own. Car-wheel makers have two to three months work on hand. Structural mills have not been able to accept all the business offered, and the bridge builders are crowded to the fullest limits of their capacity. The blast furnace output has been restricted somewhat by the coke strike, but no one is suffering. The authracite output is not far from 40,000 tons weekly and producing capacity is being put in the best possible condition. The prospects for greater activity among structural iron makers are flattering, and it is probable that within the next twelve months additional manufacturing facilities will be provided.

The favorable railway earnings, the large crops, and the increasing manufacturing demands are encouraging to producers in all branches. Machinery makers are very busy, those in the field of electrical requirements taking the lead. Prices have been steady for two months. Fluctuations are improbable. Manufacturers are better able to restrict than a few years ago. Their associations are more harmonious perhaps because of the more urgent necessity for harmony. Enterprise is encouraged by capital, and labor is generally contented with remunerative rates of wages. Consumers will not jeopardize the steadiness of the prices by a feverish anticipation of wants, such as has so often in times past disturbed the equilibrium of prices. The country has the facilities for supplying all legitimate demands, and there is but little danger that buyers will lose sight of this fact and by their unnecessary haste create an artificial enhancement of values.

Irrigation.—James O'Brien & Sons, of Smartsville, Cal., have filed a claim to 10,000 in. of water to be taken by an irrigation ditch from the Yuba river, a few miles north of Smartsville, and led down through the foothills for irrigation and other purposes. The ditch will extend to Marysville, and work has already been commenced.

A controlling interest in the Mokelumne Ditch & Irrigation Co. has been purchased by F. W. FAIRCHILD, E. A. BEARDSLEY, C. W. MCMASTER and J. M. LOGSDON, of San Diego county, Cal. B. F. LANGFORD and R. C. SARGENT are also interested. Water will be taken from the Mokelumne river and run through a main canal, 30 miles long, to irrigate farming lands in the northern and eastern parts of San Joaquin county. It is claimed there will be enough water to irrigate 300,000 acres and that they will be ready for operation next season.

ENGINEERING NEWS

VOL. XVIII. Saturday, July 2, 1887.

D. McN. STAUFFER. A. M. WELLINGTON.
EDITORS.
GEO. H. FROST, - - - BUSINESS MANAGER.

Subscription. – UNITED STATES AND CANADA, $5.00 *per Year;* $2.50 *for Six Months;* $1.50 *for Three Months; Single Copies,* 12 *cents.* FOREIGN COUNTRIES, $6.56 *per Year, or* 3 *cents per number additional.*

Drawings and Photographs *of all new engineering works or designs, large or small, of interest from their magnitude, novelty or originality, as well as newly adopted* **Standard Plans** *for engineering structures or details, rolling stock, etc., are always desired for early publication. Also* **Brief Technical Notes** *of the cost or manner of executing work, tests of materials, machines or other new devices, and* **News of New Construction** *of all kinds.* **Letters** *for publication must be accompanied by the name or card of the writer.*

WE will give in our next issue further illustrations, and a full description of the hoisting apparatus designed by WILSON BROS. & Co. Engineers, of Philadelphia, and used in the erection of the tower of the Public Buildings in Philadelphia. The general view shown this week is from a photograph courteously furnished us by Mr. Jos. M. WILSON, and gives a very good illustration of the hoisting machinery and its supporting frame-work.

IT will pay every municipal and hydraulic engineer to keep a sharp eye out on the results of the contemplated drainage improvements of the City of Mexico. The most probable result is that the works will be suspended before completion, for lack of money; but should this not be the case the experiment will be one of great interest. The conditions there are entirely dissimilar from those which exist in any other city of the world. From the comparatively remote antiquity of 1325 there has been a great city at Mexico in the bottom of an immense valley, and originally a kind of Venice "throned on a thousand isles." From that day to this the city has been utterly without drainage except into the water of the lake which originally surrounded it, and is even yet but a few feet below the level of the streets. Under these conditions, the modern city is almost of necessity founded on the rubbish and filth of ages, to a great depth. Whether it has thus risen above the waters which surrounded it in the days of CORTEZ or whether the waters have, in fact "receded," as is often said, is doubtful, but it is certain that if a trench be dug in the streets of Mexico almost anywhere, it at once fills with water and the stench from the black upturned soil is almost intolerable. For centuries nothing but the pure rare air due to its great elevation has saved the city from pestilence If it could be suddenly transported to the locality of New York the hotter weather and denser air would immediately, beyond a doubt, start diseases which would decimate the city within a few weeks.

Now the question is,—What is going to be the effect of suddenly drawing down the water which floods this vast bed of organic detritus and keeps it in great measure from decomposition? Already paludal or marshy diseases are causing frightful havoc, although by no means of a pestilential character. The doctors cry out against this state of things, but are they going to better it by draining off the water? We fear not. It is a thousand pities CORTEZ was not as good an engineer as he was a soldier. He had to destroy completely the Aztec city in order to capture it, and might as well as not have rebuilt on the fine natural site for a city to the south or west, but in an evil hour he concluded to rebuild on the old site, which was about as bad a one as could have been selected, and it is now too late to change.

THE allegations of our correspondent in our last issue in respect to the obstinate refusal of a prominent railroad line to attach any importance to alleged defects in one of their structures would seem incredible if it were not well known that such is frequently the case. As to the facts in the particular instance adduced by our correspondent we know nothing whatever beyond what he states, nor must we be understood to vouch for them in any way, but that very similar incidents do frequently occur we know. It has come to our knowledge so directly that we cannot question its correctness, that one line at least, and one of considerable prominence, has quietly pigeon-holed the recommendations of their engineer brought out by the Bussey bridge catastrophe, that all their structures be critically gone over. They are not yet prepared to face the inevitable expenditures which would follow. Nor has it been at all uncommon in the past for the recommendations of a too stringent engineer to be quietly shelved, and he along with them, and other more complaisant opinions sought for and found. The remedy for such great evils is a many-sided question, but the most obvious one, and we suspect a wise one, is mandatory legislation forbidding the future erection of iron bridges calculated for less than a specified and heavy rolling load, sufficient to cover all present and future requirements with an ample margin to spare. Such legislation, if wisely framed, would be a much valued protection of the honest and capable bridge builders and engineers against reckless and ignorant competition. As it is now, all bridge men who stand out in favor of good strong bridges do so at the serious peril of simply losing work, and yet accomplishing nothing.

AT a recent meeting of the Institution of Civil Engineers, Mr. S. W. JOHNSON, Chief Locomotive Superintendent of the Midland Railway, stated that:

"There had just been added to the locomotive stock of his company some express engines of great power and speed, as well as notable construction. They have a leading bogie, and four coupled wheels of 7 ft. diameter, cylinders 18 in. by 26 in. stroke, steel boilers which carry 160 lb. of steam, heating surface of firebox 110 sq. ft.—total, 1,360 sq. ft. The tenders of these engines carry the great quantity of 3,230 galls. or 14½ tons of water, and the total weight of the engine and tender when fully loaded is 75 tons."

Such an engine is notable for the size of its drivers, the largest in this country being 6 ft. 6 in. on the Pennsylvania fast engines, which have 18 x 24 cylinders and weigh 92,700 lbs., or about the weight of the engine described. But the standard West Shore passenger engine carries 3,000 galls. of water and weighs 96,000 lbs., with 18 x 24 cylinders, which latter may be said to be the standard for heavy passenger service, while many freight engines far exceed these figures. There is therefore no considerable advance in the leading dimensions of this engine over common American practice, but coupled drivers of 7 ft. diameter would certainly be a striking novelty in this country, and even in less degree abroad, and must give the engine an appearance of enormous power and speed, which no doubt it is able to justify by its performance. There has always been a tendency in England to use larger drivers than here for fast passenger service, and we think there are very strong reasons for believing that in this respect their practice is better than ours. The additional height which large drivers necessitate is rather an advantage than otherwise, while the lower piston speed is a very decided advantage. As it is now, the largest drivers in this country (6 ft. 6 in.) are almost the smallest abroad for similar service, or even for service where we use 5 ft. and 5 ft. 6 in. drivers here. For it must not be forgotten that although our average speed on entire trips rises on but few trains as high as in England, yet this is chiefly because of the greater number of stops, and more frequent slowing up in this country. Between such points the speeds are as high as anywhere in the world. In England, drivers of 8 ft. and over diameter, have not been at all uncommon, and BRUNEL, if our memory does not lead us astray, used 10 ft. BRUNEL went to extremes in many things, but perhaps the fact that large driver engines cost more has had too much effect on our practice, by establishing precedents from which it takes some courage to differ.

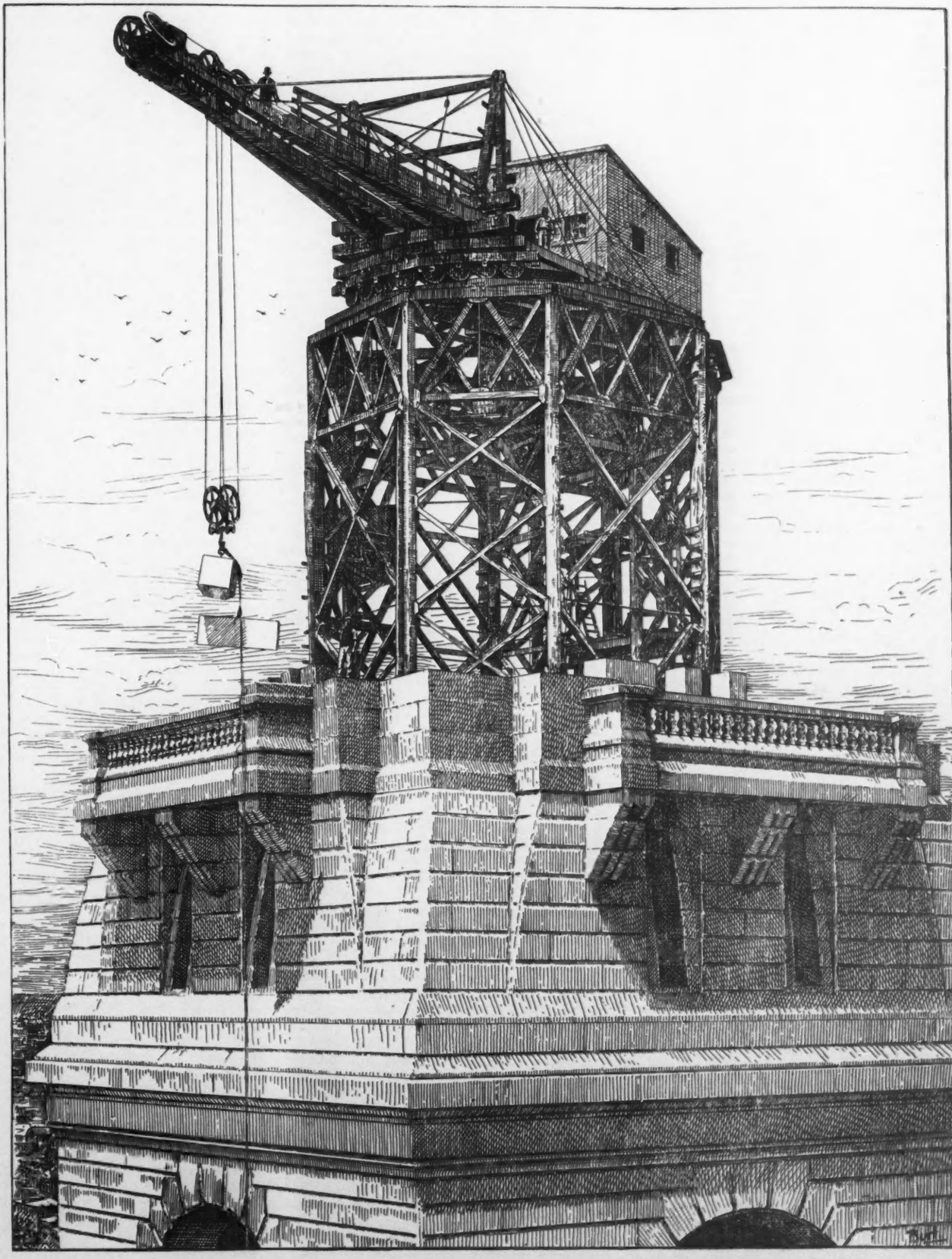
THE following interesting statement has recently appeared, showing the rapid progress of building in New York City, and especially in some sections of it. Dividing the city into seven sections, (viz., *S*, the south part below 14th street, *C*, the central portion from 14th to 59th streets, *E* and *W*, the sections east and west of Central park up to 125th streets. *N*, the small rectangle north of the park up to the same street, *H*, all the rest of the island along the Harlem river, and *A*, the "annexed district" north of the river) the state of building operations for five years past at this date (which includes a large per cent. of all the work of the year) has been as follows, in millions of dollars.

	S	*C*	*E*	*W*	*N*	*H*	*A*	Total.
1882	....	....	....	....	....	....	....	17·82
1883	4·23	6·68	7·30	0·70	0·51	1·95	0·38	21·75
1884	4·61	6·99	7·70	2·74	0·26	1·54	0·59	24·42
1885	4·73	5·17	4·82	3·46	0·80	1·92	0·86	21·75
1886	6·10	5·86	6·75	7·91	0·15	2·32	0·68	30·76
1887	7·22	4·78	9·57	9·07	2·26	5·04	2·55	40·49
				NUMBER OF BUILDINGS.				
1882	.....	.....	.....	...	....	....	....	1079
1883	109	256	412	47	25	212	149	1220
1884	180	257	420	111	16	151	255	1390
1885	187	294	278	212	43	211	260	1484
1886	244	263	430	498	92	228	208	1963
1887	328	264	533	491	131	311	459	2517

The boom which has lately struck the west side, and the great comparative activity in all parts of the city are brought out very clearly by these figures. The great day which is yet coming for the annexed district still lingers.

WITH this issue we begin a new volume and it seems an appropriate time to suggest, in behalf of our readers and not of ourselves, that the engineer is very foolish who does not preserve and bind an engineering journal. Without binding they are soon lost or inconvenient of access. With binding, an engineer has in a few years a reference volume containing the latest information on almost every side of engineering work; far more useful than any text book for reference as to practical questions, because few text-book are kept up to date, and a very large number of them are not up to date when issued.

To make our volumes still more valuable we have decided to still further improve our index, which necessitates postponing its publication for one or two issues. Without a good index, the best paper is comparatively valueless in a bound form. With it, it is but a matter of a few minutes to hunt up all that has been said and done of importance in regard to any branch of engineering.



HOISTING APPARATUS USED IN THE ERECTION OF THE TOWER OF THE NEW PUBLIC BUILDINGS, IN PHILADELPHIA, PA.—WILSON BROS. & CO., PHILADELPHIA, ENGINEERS.

We hope in several ways to make our coming volume better than any which have preceded it. One of these ways—the series o maps which we shall hereafter publish—is announced by a first appearance in this issue. The others will be better announced by performance than by promise.

The Automatic Coupler and Brake Reports.

The cause of science and good railroading has rarely if ever owed a greater debt to any one man, outside of a short list of great inventors, than it owes to Mr. GODFREY W. RHODES, chairman of the Master Car Builders' brake committee, for having rendered possible two such reports on the above subjects as honor the transactions of that Association for the current year; nor has it ever owed a greater debt to a single body of men than it owes to that Association for bringing out such information, and acting on it so judiciously. The coupler committee state with pardonable satire in the opening of their report, that there has been but a little dissatisfaction and adverse criticism on the slow progress of the Association in the coupler matter, but we cannot regard it as so entirely clear as the committee claim that this was unjustified, for without the experimental evidence which Mr. RHODES has developed no such final report on the coupler question as that of the Executive Committee could well have been made, and neither the Association nor the Executive Committee had anything to do with the bringing out of that information, even by way of recommendation or request, although it has been easily in their power at any time, to bring about precisely such tests as Mr. RHODES was finally able to make by his individual efforts and representations, outside of the strict line of the investigations entrusted to him as Chairman of the brake committee.

Rarely has any great responsibility fallen into hands so well fitted to sustain it as the conduct of the brake tests and the others which have resulted therefrom, not only in respect to experience and knowledge but in respect to colorless impartiality and that indefatigable industry, perseverance and spirit of thoroughness which alone suffices, as a rule, to bring out valuable results from tests of any kind. When this is done in the face of routine duties which might well excuse a busy man from giving any proper attention to experiments, and still less to experiments outside of the field of investigation entrusted to him, it becomes additionally notable, and it is for this reason that Mr. RHODES' services are deserving of, and we are glad to say are receiving, such wide and general recognition. They have developed facts as to both the brake and coupler questions which were in large degree unsuspected, and certainly unproven, and without which definite action of any kind would have been extremely hazardous. For example, if the first series of brake tests had been made only with 25 car trains instead of 50 car trains, which many thought were "long enough for tests," the result has shown that we should have been led utterly astray on the brake question and be still groping in the dark on the coupler question, and this is only one of several such points which might be mentioned.

But giving more credit to one man does not imply giving less to others, and certainly the Executive Committee are entitled to great credit for as admirably drawn and convincing a report as it has ever been our privilege to examine, and with what is only less rare than originating information, making prompt and proper use of it. The report proper begins by sitting down at once on the untenable position that automatic couplers must cost no more than "bull-noses," and then throw out the judicious hint, which might well have been amplified, that "Railroads are prepared to pay for improvements that cut down their operating expenses." They are in a measure, but a little better preparation will not hurt them, and if they generally realized how great a reduction may be hoped for as a joint effect of automatic brakes and couplers (to which we might add perhaps the elimination of grade crossing stops, for on many roads all three are necessary) the road for their introduction would be smoother than it is.

The committee then summarize at some length the past action of the Association on the subject, beginning with the Buffalo tests of September, 1885, when 42 couplers were tested and six of each of the two great types of couplers, the hook and the link type, were recommended for further trial. A full summary of the Burlington tests, showing the great evils and small advantages (none at all) of loose slack follows, and then the committee announce decisively that the link type must be thrown out and the hook type chosen.

They then very fairly and justly summarize the sub-types of the hook, the Janney, Miller (or Cowell) and miscellaneous; the first two being familiar to every one in passenger service. The Cowell is very properly at once thrown out, for it is justly fatal to that device, if there were no other objections, that it couples with no other freight couplers like it, so that if it were recommended the manufacturers would have a monopoly, for a time at least. The miscellaneous are of course thrown out, and thus the committee finally reach the conclusion that the Janney *type* of coupler should be the standard; and that some one coupler of that type (presumably the latest form of the Janney itself) be selected and made the final type as respects the form and action of the coupling parts. Any and all other couplers which will couple with it, under all conditions of service, are to be regarded as conforming to the standard.

Several causes combine to make this action eminently wise:

First.—The Janney is already largely in use for passenger service, and in somewhat increasing use. It is generally admitted to be a better passenger coupler than the Miller, and its introduction to freight service will hold out the obvious possibility that passenger and freight couplers may be alike; certainly a convenient result and often one of importance, both for automatic couplers and automatic brakes.

Secondly.—The Janney has perhaps more friends than any other one coupler, and has certainly had more extensive and longer test than any of its type.

Thirdly.—There are already four or five couplers which will compete with it, or can be made to, so that no patent monopoly need be feared.

These ought to be and were taken to be decided, and the committee confine the remainder of their report to pointing out that no one of the recommended couplers can be considered as entirely satisfactory, and discussing what can be done to increase their strength. Dimensions practically cannot be increased. The character of the material they think can be improved, especially if favorable results should come from the experiments which are now making on a large scale with manganese steel. The third method, on which the committee lay most stress, is to "protect the coupler by dead-woods, or better still, by spring buffers." As to the latter, it is very properly said: "It is daily becoming more apparent that we cannot consistently expect the small detail parts of a coupler to act as a buffer between such ponderous bodies as heavily-loaded freight cars brought into sudden conjunction." It will be fortunate indeed if all parties concerned can be made to see this in time, before much money and time has been thrown away in efforts doomed to disappointment, and the committee are so emphatic about it that there is reasonable ground to hope for such result. The inevitable result of the new brakes and couplers, as we have before noted, will be that the construction and handling of freight and passenger cars will be closely assimilated to each other in their more essential features, and the committee might well have added a fourth to their three methods for further development, that the introduction of freight train brakes with its resulting changes will tend to greatly reduce both the number and violence of the impacts, which couplers must withstand. It is probable that within a year the application of automatic couplers will be going on very rapidly.

The brake situation is even more gratifying than the coupler, although the committee report is less definite. The great question of what type of brake to adopt—whether the air or the vacuum—exists as in the coupler question, and there is the same irrepressible conflict between them, but this conflict can hardly be so long drawn out, although there must be a final choice with brakes as with couplers. There is no reason in the nature of things why any number of air brakes or vacuum brakes may not be made to work together with the same couplings and hose, but air pressure and air vacuum cannot be mixed together, so that a final choice must exclude one or the other. At least it is to be hoped so, for the confusion worse confounded which would result from having half the cars of the country equipped with vacuum brakes and half with pressure brakes would be very unfortunate. Under the existing system, by which freight cars go everywhere, the effect would be that, although the expense of fitting all cars with power brakes had been incurred, yet only half the cars would be practically available in any one train.

The committees report announces the following conclusions:

"While we are not prepared to make any definite recommendations at this writing as to what freight train brake should be adopted, our present information, derived from the recent tests, points to two conclusions:

"First. That the best type of brake for long freight trains is one operated by air, and in which the valves are actuated by electricity.

"Second. That this type of brake possesses four distinct advantages:

a. It stops the train in the shortest possible distance.
b. It abolishes shocks, and their attendant danger to equipment.
c. It releases instantly.
d. It can be graduated perfectly.

"The further question as to whether electricity is a sufficiently reliable element to use in freight train service can only be determined by experiment, but we think the benefit derived from electricity are so manifest that we think the experiment is well worth trying."

That the committee leaned strongly in favor of electricity is evident from other facts of their report, and indeed from the above summary of advantages, for without it air brakes certainly do not abolish shocks, so far as is yet proven. We must confess that we have heretofore been disposed to believe, and in a measure are yet, that the shocks cannot be abolished without electricity, but some very remarkable results which have been accomplished since the formal tests may well lead to a suspense of judgment on this matter, and excite hopes that the end may yet be accomplished.

Without going into details which would be premature the Westinghouse triple valve has been made very greatly more sensitive, we are informed, so that the brakes are applied on the fiftieth car in 2½ seconds instead of 15 to 25 seconds, as in the 1886 tests, with the effect that the train was stopped from 36 miles per hour in 540 ft. with a slideometer movement of only 6¾ in., which amounts to little or nothing, 12 in. being accepted as the objectionable limit. In other words, if we are correctly informed, the brake application travels about as fast as sound through the air, so that if a whistle were sounded on the engine, simultaneously with the brake application both sound and pressure would arrive at the same time.

It goes without saying that this implies a heretofore unheard of sensitiveness in the triple valve. The very comparison with sound indicates this. Sound travels through free air about 1125 ft. per second, and through pipes of some considerable size about 1000 ft. per second. The louder the sound (*i. e.* the more intense the vibrations) the faster it travels, if anything, and by analogy we might except that the pulsation arising from a quick and sudden escape of air might travel equally fast even though a very small pipe, and cause a momentary undulation of pressure which might be utilized to apply the brakes, although there could not possibly be any permanent change of pressure in so short a time. Mr. WESTINGHOUSE has shown such remarkable, mechanical genius in so many ways that when he is hopefully attacking a problem all we can reasonably do is to hopefully await the result: but should he succeed in applying brakes so quickly by apparatus which is not so delicate as to impede its practical use we cannot but feel that it will be one of the greatest of his many mechanical achievements.

The mere question of comparative quickness of stop and percentage of efficiency is not dwelt upon much by the committee, and very properly. Its main significance in non-electric stops, so far as permanent merit is concerned, is the light which is shed on comparative quickness of application. In electric stops, this question is, or may be eliminated, and it then becomes a mere question of proportion to get any brake pressure desired. It would be a great pity if the mere superiority of one company over another in getting its apparatus proportioned just right for a test should be allowed weight in itself. Such superior quickness as may result from dealing with 80 lbs. pressure instead of 10 lbs. vacuum, or from essential features of the apparatus, should alone be considered. In the engine tests there was no difference of efficiency, so far as we can perceive, which can be regarded as of any significance. We find, however, that we did the Eames brake an injustice, in one of our former comparisons, in comparing an automatic stop this year with a "straight vacuum stop last year, without mentioning the difference, and from later advices we learn that the tenders were all more heavily loaded than we assumed, so that our percentages should have been somewhat higher, and somewhat more favorable than last year instead of slightly less so. But these are minor questions. The two chief ones are: (1) Is it or is it not necessary and feasible to use electric application for air brakes, and (2) granted air brakes, should the air or vacuum type be preferred? The buffer brakes, as a permanent type, seem to be practically eliminated from the problem, and that is a great gain, and the small number of live competitors and their great mechanical skill may well encourage hopes that the two remaining questions will soon be settled.

The Distribution of the Membership of the American Society of Civil Engineers.

We have rather hastily utilized for the purpose of showing the distribution of the membership of the American Society of Civil Engineers one of a series of special maps which we propose to issue at frequent and regular intervals hereafter. The primary object of these maps is to graphically exhibit the prospects and progress of construction in the United States and Canada; chiefly for railroad work, but also including water-works and any other general information that can be conveyed in this manner. When this can be done at all it is by all odds the best manner of conveying such information, and is much more readily grasped by the general reader than would be pages of cold figures and text. In fact it is the only method of rapidly scattering important information in this busy age.

The general map of the United States, which we use for the purpose in hand, is to be utilized for the summarization of data, and the next map, to appear in our following issue, will show, printed in red, the actual track laid on railroads in the United States during the last year. This mileage map for 1886 will be somewhat late in appearing, but it was deemed best to commence the regular series with this exhibit for future comparison, and as is usual in any new departure more time was consumed in the organization of staff and the gathering and verification of data than was originally expected. The companion maps will be on a scale three times as great as the present map to better show the information desired.

The Society map plainly exhibits the concentration of members along what may be called *the* railroad belt of the United States, and also the bunching of engineers in the large cities. This is a natural result when we consider that the massing of railroad systems calls for the employment of many engineers, and the large cities, aside from their local demands, attract engineers as the source of nearly all new engineering enterprises.

In the South, and the country west of the Mississippi Valley, the membership is very scattering, and the cause thereof is again plain. These sections have few large cities to attract engineers in a business sense and the railway systems are so scattered comparatively that the engineers who find employment upon them lack to a certain degree that incentive and opportunity for social affiliation that the concentration of any body of professional men usually brings about.

For some reason, difficult to explain, the American Society of Civil Engineers yet lacks the quality of attracting to itself the mass of scattering civil engineers, as does the Institution of Civil Engineers, for example, whose members find employment in every clime. Speaking of the English society, one point is worthy of consideration and may in itself account for the increasing membership and consequent important standing of the Institution of Civil Engineers. In the last report of this body we find it has 4,347 members of the regular grades, with but 1,568 full Members. But in addition to this 4,347, they have also 949 of the student class, young men who are growing up with the Institution, thoroughly imbued with all its traditions and in a position to profit by the experience and teaching of their elders. Very naturally this student class is a powerful reserve from which the Institution is to be recruited. And as these young men usually start near home and within reach of the parent society, they in due course of time enter the Institution as members, no matter to what part of the world circumstances in the mean time may have sent them.

We cannot help feeling that if this feature was in some manner engrafted upon the present organization of the American Society of Civil Engineers a future map of membership would show not only increased numbers but a more even distribution. The engineers are there now but lack the "red dot" to show their connection with the American Society.

! ! ! [Just as we were ready to go to press (11 A. M Friday) we were informed that the maps above referred to were destroyed by a fire in the lithographic press room. On investigation we found a portion only spoiled and we hope to have enough left to "go round." By dint of extra exertions and inducements we expect to get the edition printed in another office (the stone not being spoiled) in time not to delay our regular issue. If any reader fails to receive a map he will understand the reason and that it is not easy of remedy.—ED. ENG. NEWS.]

Topical Discussions at Conventions.

An attempt appears to have been decided on to introduce a somewhat new feature into the Conventions of the American Society of Civil Engineers by the issuing of lists of certain live topics for discussion, in place of confining the proceedings to the mere reading and discussion of formal papers. The following list for the coming Convention bearing on the great question of the proper construction and maintenance of bridges was received by us, unfortunately, just too late to appear in our last week's issue, but the questions are certainly pertinent and offer opportunity for a very lively and interesting discussion, should the ball happen to be well started:

One of the subjects to be discussed at the approaching Convention is the Inspection and Maintenance of Railway Structures. A number of suggestions have been made and the Committee desires your opinion in regard to the following and such other points as may occur to you.

It is desired to collate the suggestions received, and you are invited to reply at whatever length may be convenient to you, sending the reply to the Secretary that it may be received in time for the Convention. For this purpose it should arrive at New York not later than June 30, or it may be addressed to Hotel Kaaterskill, Greene County, N. Y., so as to arrive there not later than July 3.

1. What measures, legal or other, can be taken to insure a proper inspection of railway bridges?
2. What is proper bridge inspection?
3. Should there not be a standard specified rolling load much heavier than is now generally used, and a specified engine wheel base for rolling loads?
4. Is it not expedient to adopt a standard bridge floor?
5. Should not bridges of small span be made strong enough for a buckle-plate floor, and a continuous coat of ballast on the bridge, and if so, up to what span should this apply?

Should not a safety guard (Latimer) be used at all openings over a certain width?

7. Should there not be required either overhead crossings, or, in their place, interlocking apparatus with derailing switches?
8. Is legislation as to any of these points, or as to any others you may suggest, expedient, and if so, what sort of legislation?
9. In this connection the experience of the Master Car Builders' Association has been referred to, which, it is stated, has proved that the action of large committees reporting to the Society, and the adoption [recommendation, ED.] of standards after ample discussion, have been found very valuable.

The reference in the last column to the Master Car Builders' Association is a very appropriate one, for their proceedings may well afford a useful hint. The chief excuse for being of the Master Car Builders' and Master Mechanics' conventions is either the recommendation of standards or the discussion of special topics, set in advance, on which committees are appointed to report without any expectation (as a rule) that their reports will be exhaustive, but merely that they will discuss such phases of the question as are salient or new, or in which they happen to be especially interested. These reports are sometimes very long, but often quite brief, and one of their most important purposes is to start discussion on the topics to which they relate. Set papers on subjects selected by the writers are the rare exception.

No exact parallel for these organizations exists in England, although the Germans have several very similar and even more perfect organizations, and the proceedings of our own engineering societies have been modeled exclusively on the English practice, which is to

hold meetings for the "reading of papers" only, trusting to Providence to have them readable and on live topics, and to merely discuss what is presented. In part there is good reason for this, and it is common to the practice of the whole world. A body consisting chiefly of educated men engaged in scientific pursuits, and all fairly well accustomed to wielding the pen, can count on its individual members knowing what is worth presenting and when and how to present it, as more purely practical bodies cannot. Societies devoted to the abstract sciences can hardly adopt any other plan.

But such a body as the American Society of Civil Engineers or of Mechanical Engineers occupies an intermediate position. The reading and discussion of papers will naturally always continue to be a prominent feature, but there is a large class of questions of a practical nature on which multitudes of their members have to act, and—easily susceptible in their nature of reduction to one or more fixed standards—discussion of which at least is profitable and interesting, and on which some united action of a recommendatory nature—carefully guarded so as to make it such, in fact—might be productive of great good.

As respects engineering structures, to which the suggested topics chiefly relate, such discussion and possible recommendatory action seems particularly desirable because legislative action on the same topics and others allied to them is being attempted in all directions, which is, to a very large extent, ill-directed and ill advised. The public feel that something should be done; they do not know exactly what. Engineers who are much better known to the political powers that be than to their professional brethren are very often relied on for advice, and the result is a great deal of short-sighted and imperfect legislation. The American Society of Civil Engineers now easily has it in its power to give direction and form to all the technical features of such legislation, and what could tend more powerfully to extend the usefulness and influence of the society than to draft off, after thorough discussion and perhaps reference, to a committee of 50 or 100 through letter ballot, certain recommendations as to what should be the minimum strength of bridges, and as to their best protection from accident? Public action on these matters must come, and someone must formulate it, and surely no body is better qualified to formulate in a recommendatory way the wise limits for such action than the national society of civil engineers. It is not dabbling in politics to do this. No true friend of the society would suggest that the least effort should be made to push any such conclusions on the attention of legislators. It is merely determining in definite form what is the best average judgment of the men best qualified to judge on certain questions of general and public interest. If such a determination were made it would carry with it almost the force of law, and we may be quite sure would be at once adopted as such by many State legislatures. What they will do without such guide, who can tell?

The argument is still stronger in respect to certain details which are not of a nature to require legislation, but yet are such as to make some standard of practice highly desirable. The question of the proper form of rail sections and of wheel sections is a prominent example, on which a committee of the Society is now preparing a report. It is with this class of questions that the Master Car Builders' Association has chiefly dealt, and it has gradually elaborated, year by year, a long list of standards which have accomplished great good. The adoption of these standards has no binding force on any one, not even on those who recommend and vote for them. The action merely amounts to saying that two-thirds of the members, after discussion, agree in the belief that a certain way of doing something or a certain size for certain parts, is on the whole the best. Sometimes later experience shows that mistakes have been made, but then the action is merely reconsidered and a new standard adopted. The assumption merely is that the united judgment of a great number, while in no way infallible, is likely to be more nearly right than the unaided judgment of individuals.

The limits within which general discussion or specific recommendations are possible are undoubtedly narrow. Fortunately for the profession individual judgment, based upon experience and study, must ever be the chief guide for the design of engineering work, for the conditions are so variable that no fixed rules or formulæ can be devised to fit them. Otherwise, engineering would not be a profession, but a mere trade. But there is a large class of details, especially in railroad and bridge work, for which fixed rules of practice are both feasible and desirable. Individual judgment is a good thing in its place, but when it leads a dozen different men to get up a dozen different rail sections or a dozen different bridge-floors, when some one carefully studied plan would be equally applicable to all the structures, and probably be better than any one of the dozen individual efforts, it is exceeding its proper field of usefulness.

The great question of what should be done to guard against the erection of weak bridges is also, and emphatically, one on which some more or less formal recommendation by the American Society of Civil Engineers as to what should be regarded as good practice in this matter might be productive of the greatest good. There is probably no bridge engineer of any standing in this country who does not believe and know that the average bridge is proportioned far too light for true economy. Most of them would be very glad to build heavier and more permanently safe bridges, but while every railroad president or officer is as free to fix the strength of a bridge as he is to fix its length or material there are obvious reasons why the tendency to sail as close to the wind as possible, should be irresistible by any one person or firm. Few men are disposed to be modern Don Quixotes, even in a good cause.

There is a certain difficulty in discussing any topics of this nature in the American Society of Civil Engineers, and especially in in any recommendatory action, that it is a mixed body, and not like the Master Car Builders and other like bodies composed solely of men devoted to one narrow specialty. But it would be easy to make too much of the difficulty. After all is said and done, an engineer is an engineer. It is the strength of the American Society, as it is the strength of this journal, that their interests and their knowledge are not limited to the particular kind of engineering work on which they happen to be for the moment engaged, but that they to a very large extent make it a practice to keep informed on the other branches of engineering,—in part for the very practical reason that they do not know how soon they may need such knowledge. On the other hand, only a small fraction of the Master Car Builders' Association have had any technical training which qualifies them to decide original mechanical problems outside the range of their own immediate shop practice. There are a few highly educated and able mechanical engineers in that body, and the number is fortunately increasing, but as a body it is poorly qualified for example, to pass upon such a delicate engineering problem as what should be the proper form of either rail-heads or wheel-tread, and their letter ballot on such a question is not entitled to nearly the weight that a general ballot of the American Society of Civil Engineers would be on any one of the questions above propounded. A ballot of that kind would be such an innovation on the past practice of the Society that we fear that stage may never be reached, but the questions will at least open the way to a lively discussion, which may prove an agreeable variation of the sometimes tedious programmes of the past.

CORRESPONDENCE.

Bags vs. Barrels for Cement.

NEW YORK, June 16, 1887.

EDITOR ENGINEERING NEWS:

Your editorial of May 21st and its continuation of May 28th upon this subject bids fairly to open the whole subject of cement manufacture as well as the transportation and storage. You will find it difficult to reach a conclusion unless the scope of any discussion covers the whole range for much of the question of transportation and storage is involved in the kind of material used in manufacture, the method and the result. Allow me to make a few *apparently* "dogmatic" assertions for all of which proof can be presented, and reason submitted, but are withheld, unless called for, that the columns of your paper may not be too far trespassed upon.

There is a class of natural cement that will *not* allow of transportation in *bags* and give the best results, these are weak in "base," lime or magnesia, and have an excess of silica, and will allow of the use of a less quantity of sand, these cements are not economical in use or transportation, nor safe in storage in either "bags or barrels" for any length of time, and are usually judged by their color, which indicate nothing except the amount of iron contained in the rock of which they are made, or coloring matter added.

There are natural cements strong enough to require seasoning and to bear transportation, storage and sand equal to any Portland. The expression "suitable package" covers both classes; put the weak one in barrels, give as little storage as possible, that is use quickly, and use less sand if you *use* this class of natural cements, or use the stronger variety, well seasoned and put it in "suitable package," which in this case allows of bags, and as it will stand more sand you have a stronger article more cheaply and more easily handled.

This operation would apply also to Portlands for they too are subject to variations of the same nature, and this country, as a rule, does not get the best grade of importation.

There is absolutely nothing at present to determine which, Portland or natural cement is the better, 50 years have scarcely elapsed since "Portland cement" was invented. There are locks in the Erie canal of that age, built of natural cement intact to-day, and as hard as any cement used or perhaps can be. The comparison of excellence can be made better 200 or more years hence than now. Apparently natural cement is as enduring or more so than any material that it cements together, no work has ever yet been projected, that approached the limit of crushing or tensile resistance of a strong well made natural cement, nor is any likely to be projected. The Washington monument, the various bridges, aqueducts, or the projected "Quaker dam" do not require but a fracture of the strength inherent in a good natural cement. In "suitable packages" it may be relied upon. Portland cement as a rule shows better result in the first year or two of time, but the early maturity like natural phenomenon may but presage a shorter period of matured excellence followed by more rapid deteriorations. At present, there is no experience to determine the superiority of one over the other. Apparently that is best which is, all things considered, cheapest in first cost, in handling and in making mortar. Natural cement, has been used to much the larger extent in

the country. Probably ten to one in comparison, and the failures of the natural cement certainly are no greater in proportion to use; in fact many can largely be traced to poor sand or ignorant manipulations. Of course there is considerable poor cement in the market, both Portland and natural, but it can be easily avoided. The writer has seen natural cement that showed 125 lbs. in the usual twenty-four hour test, not occasionally but steadily, that had been stored in bins for six weeks, and then in bags for two months, and has seen the same cement made into briquettes broken and ground six hours after, and made into briquettes again (not re-calcined) and at the end of ninety days broken, and showing a high tensile strength, The bags in this case were certainly a "suitable package."

The conclusion of the question started by you "Bags *vs* Barrels" must inevitably be.—"That it is better to use the best cements attainable, whether it be natural or Portland, and that using the best permits the use of bags as suitable in a large majority of cases, particularly upon large contracts, and this result is a very material saving of expenditure without sacrifice of other material and good results." Your truly. P.

Transition Curves and Centers of Gravity.

BINGHAMTON, N. Y., June 13, 1887.

EDITOR ENGINEERING NEWS:

I enclose a sketch of a scheme for constructing a railroad curve which I think may have some merit, but have never seen discussed.

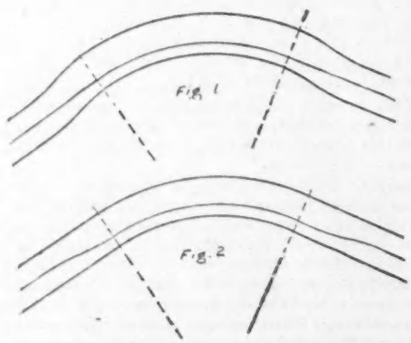
The idea is that the center of gravity of the car shall follow the theoretical line of the road, the rails being thrown out *pari passu* as the cant is given, as shown in Fig. 1.

The inner rail should also be depressed as the outer one is raised, following a spiral on a cylinder of which the path of the center of gravity is the axis.

This makes an ugly looking kink in the track, but on track as laid in the ordinary manner it is the center of gravity which passes through the kink; which, though invisible to the eye, is evident enough to the other senses.

Fig. 1 shows the proposed scheme; Fig. 2 shows track as ordinarily made. The center line in each case showing the path of the center of gravity. The figure on page 298 of Mr. WELLINGTON'S "Economic Theory of the Location of Railways," should accompany these for further illustration.

I see no reason why a car should not in this manner pass without shock from tangent to curve of any radius. This principle is made use of by all animals



n walking; by birds in flying also; and even the path of a vessel has some similarity, though the cant is given in the opposite direction by the momentum of the upper part of the mass.

Yours truly, J. P. N.

[Our correspondent has with great skill elaborated precisely the wrong idea. Instead of his tangents swinging out just before they come to the curve they should swing in. A train running at high speed over such alignment as he suggests would almost certainly leave the track.

The conditions of maximum ease of motion are these:

On a tangent: Track level (presumably, at least; there are some grounds for suspecting that a slight and uniform super-elevation of one rail might have a beneficial effect).

On a curve: That the resultant of the vertical force of gravity and the horizontal centrifugal force shall be perpendicular to the plane of the rails.

Passing from tangent to curve: That the radius of curvature at every point shall be such as will generate a centrifugal force which will make the aforesaid resultant perpendicular to the plane of the rails at that point.

As the super-elevation must gradually and uniformly increase within a short distance from zero to the full elevation of the curve, so the degree of curvature should—not make a sudden jump from zero to perhaps 10°, but gradually increase between those limits *simultaneously* with the super-elevation, both thereafter continuing constant. This necessitates an alignment precisely the reverse of that shown in our correspondent's cuts, and gives a short and quick-changing cubic parabola at the end, succeeded by a circular arc of uniform radius. The parabola proper is not at all well suited for railroad use, even in theory, and still less practically. It gives almost as sudden a change from a tangent as a circular arc, while it gives a constant minute change of radius in the main body of the curve, which is not only not desirable but positively objectionable.—ED. ENG. NEWS.]

Wellington's Theory of the Economic Location of Railways.

"It appears to me that the work is monumental. In completeness, vast; in treatment, profound and thorough. It stands alone as an example of adequate presentation of that department of engineering science to which the world is most indebted for the phenomenal advances of the last half century. But the suggestion of only a single department of engineering is incorrect, since your book brings home with startling force the truth that every really competent specialist must lay hold of every related branch of knowledge. So in this case, a consideration of essential principles of political economy, sound financial policy and railway management, is inevitably connected with the physical properties and production of materials, surveys of routes, construction of permanent way, operation of rolling stock, etc.; while the laws of mechanics, a wide range of physical principles, including thermodynamics, and the labor question, find a pervading application. And above all and throughout the whole, like the universal ether in the material world, is the essence of "common sense."

"The would-be critic must stand aghast at the task before him, and my attitude at present can be only that of a student embarrassed for the time by the riches of material."

Very truly yours, ROBERT FLETCHER,
Prof. of Civil Engineering, Thayer School of Civil Engineering, Hanover, N. H.

"I am very much delighted with the copy of your new book on railway location. I read the first series of articles as they appeared in the "Railroad Gazette" with a great deal of interest and profit, purchased a book when they were published, and recommended it to my classes in railroad surveying as presenting the most rational attempt at the solution of the problem with which I was familiar; and with many succeeding classes have regretted that it was out of print and inaccessible.

"In a year our undergraduate course will be so extended as to take up the subject of railroad economics, when, if the book proves, on careful examination, to be as good as everything now indicates, we shall carefully consider its adaptability as a text-book. It will certainly stand at the head of the standard books on the subject recommended to our students and graduates."

Very respectfully yours, C. L. CRANDALL,
Cornell University, Ithaca, N. Y.

"I only had time to read one or two chapters, and glance along in it yesterday (June 12), but shall read and ruminate upon it for a good many evenings, until I have covered the whole ground. At present I can only say that I have a great admiration for the pluck and perseverance which has enabled you to do this immense amount of work in addition to your regular daily labors."

CHAS. PAINE, Vice Prest. and Gen Man.
Philadelphia Co., Pittsburg, Pa.

"To say that I am much pleased, so far as I have been able to look it over, is very little." JOHN S. TITCOMB, Cheyenne, Wyo.

"Please send me thirty copies of 'Accidents in Mines;' also two copies of 'The Economic Theory of the Location of Railways.'"

Very truly, ECKLEY B. COXE, Drifton, Pa.

"Book received in good shape. The best $5 investment I ever made." Yours truly, U. S. LUTZ, Bloomsburg, Pa.

"I expect your book to be of great assistance to me in showing our construction company the expensiveness of badly built roads."

ARTHUR POU, Chief Engineer
S. D. & W., S. I. R. R., Savannah, Ga.

"Please send me six copies of Wellington's 'Economic Theory of the Location of Railways.'" JOB TUTHILL,
Asst. Eng. D. L. & N. R. R., Ionia, Mich.

"I am well pleased with the book; it is the work of a master. The book will be recognized as a standard on railroad matters."

SETH DEAN, Glenwood, Ia.

"Send me five copies 'Economic Theory Location of Railways, by express, care of Engineer's Office, Burlington & Missouri River R. R., Lincoln, Neb." F. C. TUCKER, C. E.

"Send five copies Wellington's 'Economic Theory of the Location of Railways.'" SAMUEL REA, 233 S. Fourth St., Philadelphia, Pa.

"Enclosed please find $34, for which send six copies of 'The Economic Theory of Location of Railways.'" R. C. SIMONS,
Chicago, Santa Fe & California Ry. Co., Kansas City, Mo.

"I have heard the work quite warmly endorsed amongst railroad men." JOHN DUNN, President's Office,
Illinois-Central R. R., Chicago, Ill.

"Gives the greatest satisfaction." BOYD EHLE,
Panhandle Construction Co., Quanah, Tex.

"Please send five copies 'Economic Theory of Location of Railways.'" JOS. O. OSGOOD, Chief Engineer,
Toledo, St. Louis & Kansas City R. R., Toledo, O.

"Please send one copy of Wellington's 'Theory of Economic Location of Railways.'" S. R. CALLAWAY, Gen. Man.
U. P. R. R., Omaha, Neb.

"Please send me a copy of the Economic Theory of Location of Railways.'" JAMES J. HILL,
President St. P., M. & M. R. R. Co., St. Paul, Minn.

TYPOGRAPHICAL ERROR.

BALTIMORE & OHIO R. R. CO., OFFICE OF CHIEF ENGINEER,
BALTIMORE, June 25, 1887.

A. M. WELLINGTON, ESQ., C. E.

DEAR SIR.—In looking over your recently published work on "The Economic Theory of Railway Location," I have detected the following typographical error. As the second edition is soon to go to press, I write you about it so that it may be corrected.

Page 798, paragraph 1038, line 31 "narrow wood-beds" should read "narrow road-beds."

I have had but little time yet to look over the work thoroughly, but am sure that it will prove of lasting benefit to the profession, and there is no doubt that such a work was sadly needed.

Very truly yours, JAMES G. DAGRON,
M. Am. Soc. C. E., Chief Inspector of Bridges.

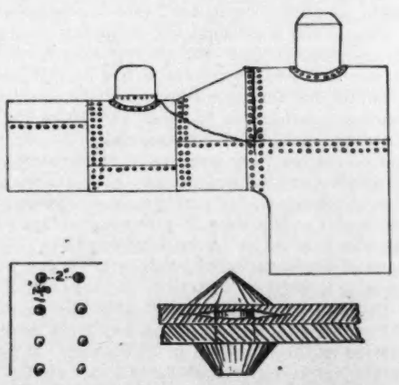
Baltimore & Ohio Boiler Explosion.

CHESTER, Pa., June 8, 1887.

EDITOR ENGINEERING NEWS:

The Baltimore & Ohio locomotive which exploded in Chester, Pa., on Tuesday last with such disastrous results, was built in the company's shops in Baltimore. To all appearances the boiler iron is good. The boiler plates were not welded. Two rows of rivets held the same, the rivets being only ⅝-in. apart nor were they staggered.

For a high pressure freight engine does not this reveal the weak spot? The fracture, so everything tends to show, was made on a line of rivets and is



clearly defined as outlined on the enclosed sketch. The rupture occurred in a new plate, recently put in I suspect there were more of the blisters shown than I actually observed. C. E. D.

[The rivets are too closely spaced for good practice, but not so much so as our correspondent seems to imagine. The worst defect is the form of joint, which is a very bad one, wholly unwarranted by good practice. The seams were rather made weaker than stronger by the second row of rivets when arranged as our correspondent shows. The Baltimore & Ohio, along with much that is admirable in its management, has something of a weakness for getting hold and keeping hold of antiquated and peculiar details of construction, but probably has few engines with such riveting as shown, and those old ones.—ED. ENG. NEWS.

SOCIETY PROCEEDINGS.

The American Master Mechanics' Association opened its twentieth annual meeting at St. Paul last week with 250 delegates present. Committees reported on all the following subjects:

"Proportion of locomotive cylinders; the various types of traction increasers; the various types of crosse-heads and guide bars; the various forms of piston packing in use, results obtained, etc.; washing out and cleaning locomotives; most economical mode of raising steam, etc.; coaling up locomotives; standard form of tire section: what control has the engineer over the wear of driving wheel tire."

Acting President JOHANN, Supt. of Motive Power, Texas & Pacific R. R., presided. Some of the reports and discussions, which we shall abstract at a later date, were quite interesting and valuable, but there were few questions.

The American Water-Works Association will hold its Seventh Annual Meeting at Minneapolis, Minn., on July 13, 14 and 15, and indications are that there will be a large attendance and an unusually interesting meeting. The published programme contains some thirteen papers on topics of interest to water purveyors and consumers, including in the list of authors some very well known names.

List of Members and Guests who had signified their intention to be present at the Annual Convention of the American Society of Civil Engineers, up to June 20.

(Ladies accompanying Members are noted by Asterisks.)

Adams, Col. J. W.* Brooklyn, N. Y.
Andrews, Horace, Albany, N. Y.
Archbald, J.* Scranton, Pa.
Arden, Gen. T. B.* West Point, N. Y.
Bacon, J. W.* Danbury, Conn.
Baldwin, T. W.* Bangor, Me.
Barbour, W. S.* Cambridgeport, Mass.
Bassel, B. Technical Attaché, German Legation.
Beardsley, Arthur, Swarthmore, Pa.
Belknap, W. R. Louisville, Ky.
Bissell, H. Salem, Mass.
Bogart, John* *. New York.
Bogart, J. H. New York.
Bolier, A. P.* New York.
Bouscaren, G. Cincinnati, O.
Bonzano, A.* Phœnixville, Pa.
Bonzano, Hubert Phœnixville, Pa.
Bradbury, H. R.* New York.
Bradley, T. C. New York.
Brown, Prof. C. N. Columbus, O.
Brown, T. E. Jr.* * * New York.
Burr, W. H.* Phœnixville, Pa.
Brooks, Fred. Boston, Mass.
Burgwyn, C. P. E.* Richmond, Pa.
Burnham, Geo. Jr.* Philadelphia, Pa.
Calkins, F. A. Brooklyn, N. Y.
Card, W. W. Pittsburg, Pa.
Cartwright, Robert, Rochester, N. Y.
Chapman, W. D. Akron, O.
Clarke, E. C. Boston, Mass.
Clarke, T. C.* New York.
Coffin, Amory,* * Phœnixville, Pa.
Cohen, Mendes,* Baltimore, Md.
Cole, Wm. T.* New York.
Collingwood, F.* Elizabeth, N. J.
Compton, Prof. A. G.* New York.
Cooper, Theodore, New York.
Crandall, C. L. Ithaca, N. Y.
Croes, J. J. R.* New York.
Curtis, C. G.* New York.
Darlington, F. G.* * * Zanesville, O.
Davis, J. P. New York.
Dawley, E. P. Providence, R. I.
Deans, J. S. Phœnixville, Pa.
De Funiak, Fred.* Louisville, Ky.
Dickinson, P. P.* New York.
Dorsey, E. B. New York.
Eckert, E. W. New York.
Endicott, M. T. Norfolk, Va.
Felton, H. C.* Camden, N. J.
Field, Gen. Geo. S.* Buffalo, N. Y.
Fisher, Clark, Trenton, N. J.
Fitzgerald, D. Brookline, Mass.
Flagg, J. F.* * New York.
Fogg, C. E.* * Poughkeepsie, N. Y.
Frilley, Jos. Chief Engineer, U. S. N.
Frith, A. J. Columbus, O.
Frost, G. H.* New York.
Fuller, F. L.* Boston, Mass.
Gibson, Wm.* New York.
Goodale, A. M. New York.
Gosling, C. B. New York.
Graff, Fred.* Philadelphia, Pa.
Gray, S. M.* Providence, R. I.
Greene, Gen. G. S. New York.
Greene, G. S. Jr., New York.
Greene, Carlton, New York.
Griffin, G. S. Phœnixville, Pa.
Guthrie, E. B.* Buffalo, N. Y.
Hamilton, Wm. G New York.
Haskins, Wm. J. New York.
Haswell, C. H. New York.
Hayes, E.* * Buffalo, N. Y.
Haynes, C. F. Boston, Mass.
Hill, A. B. New Haven, Conn.
Hodgdon, F. N. Boston, Mass.
Howard, F. B,* Detroit, Mich.
Howe, A. M. Boston, Mass.
Houston, John,* Jersey City, N. J.
Hunt, A. E.* Pittsburg, Pa.
Ives, Chauncey, Chambersburg, Pa.
Jennings, W. H. Columbus, O.
Johnson, J. B.* St. Louis, Mo.
Jones, Washington, Philadelphia, Pa.
Just, G. A. New York.
Kennedy, John, Montreal, P. Q.
Kent, Wm.* New York.
Kimball, G. A.* Boston, Mass.
King, P. S. New York.
Kirchoff, C. New York.
Kirtland, A. B. Blairsville, Pa.
Knight, W. B, Kansas City, Mo.
Kuichling, E.* Rochester, N. Y.
Latham, H. H. Chicago, Ill.
Lee, T. B.* New York.
Lewis, J. F.* New York,
Loweth, C. F, St. Paul.
McAlpine, Wm. J.* New Brighton, N. Y.
McCollom, T. C. Philadelphia, Pa.
McComb, D. E. Washington D. C.
McMath, R. E. St. Louis, Mo.
MacNaughton, Jas. Albany, N. Y.
Mann, G. E.* Buffalo, N. Y.
Martin, C. C.* * Brooklyn, N. Y.
Merriman, Prof. M. Bethlehem, Pa.
Michaelis, Capt. O. E.* * Troy, N. Y.
Moore, Robt.* St. Louis, Mo.
Morse, H. G.* * Youngstown, O.
North, Ed. P.* * New York.
Noyes, A. F.* * West Newton, Mass.
Noyes, E. B.* Fort Edward, N. Y.
Ockerson, J. A. St. Louis, Mo.
Odell, F. S. New York.
Opdyke, S. B.* New Haven, Conn.
O'Rourke, C. A. New York Associated Press.
O'Rourke, J. F. Poughkeepsie, N. Y.
Pegram, G. H. North Scituate, Mass.
Perkins, C. P. Philadelphia, Pa.
Peterson, P. A. Montreal, P. Q.
Prindle, F. C.* East Orange, N. J.
Prout, H. G.* New York.
Rathbun, E. W. Napanee, Canada.
Rea, Samuel, Philadelphia.
Reeves, P. S.* Philadelphia, Pa.
Richards, J. R.* Boston, Mass.
Richardson, B. F. Philadelphia, Pa.
Ricketts, Prof. P. C. Troy, N. Y.
Ringwalt, J. L. Philadelphia, Pa.
Roberts, Percival Jr. Philadelphia, Pa.
Roberts, Wm. Waltham, Mass.
Rockwell, Samuel, St. Paul.
Seaman, H. B. Philadelphia, Pa.
Schaeffer, J. S.* * Newark, N. J.
Schneider, C. C. New York.
Schneider, C. H. Waterbury, Conn.
Shaller, R. A. Chicago, Ill.
Sloan, R. I. New York.
Smith, Oberlin * * Bridgeton, N. J.
Starling, Wm. Greenville, Miss.
Stauffer, D. McN. New York.
Stearns, F. P.* Boston, Mass.
Sterling, Allan* * Deseronto, Canada.
Sublette, G. W. Minneapolis, Minn.
Tappan, Roger* Haverhill, Mass.
Thompson, John* New York.
Thomson, G. H. New York.
Thurston Dr. R. H.* Ithaca, N. Y.
Tidd, M. M.* * Boston, Mass.
Tingley, Geo. C.* Providence, R. I.
Tomkins, Calvin, New York.
Towle, Stevenson,* * * New York.
Trotter, A. W. New York.
Van Zile, H. L. Albany, N. Y.
Wagner, S. T. Phœnixville, Pa.
Walker, W. W. Cedar Rapids, Ia.
Wheeler, S. S. New York,
Wilson, Jos. M.* Philadelphia, Pa.
Ward, C. D.* Oswego, N. Y.
Wardlaw, J. R.* Oswego, N. Y.
Wellington, A. M.* New York.
Welton, N. J. Waterbury, Conn.
Wetherill, W. C. Liberty, Mo.
Wiley, W. H. New York.
WORTHEN, W. E.* New York.

PERSONAL.

J. A. COOPER, Master Mechanic of the New York, Pennsylvania & Ohio R. R., has resigned his position.

M. M. GREENE, President of the Clinton National Bank at Columbus, O., died recently at Columbus, at the age of 57. Mr. GREENE was the builder and former President of the Columbus, Hocking Valley & Toledo R. R.

C. W. STANIFORD has been appointed Division Engineer in charge of the first division, 32 miles, of the Cumberland Valley branch of the Louisville & Nashville R. R., relieving WM. MCCLOY, who is placed on surveys.

JONATHAN BARRETT is Chief Engineer of the West Virginia R. R., with headquarters at Morgantown W. Va.

GEORGE LEIGHTON is Chief Engineer of the Mobile & Dauphin Island R. R., with headquarters at Mobile, Ala. M. BARTHOLOMEW and T. K. G. WRIGHT are Assistants.

CHANGES OF ADDRESS, MEMBERS OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

FRANK A. CALKINS, Care *Sanitary Engineer*, 84 Fulton St., New York.
S. C. HEALD, 31 Milk St., Boston, Mass.
RANDELL HUNT, Bridge Engineer, Chicago, St. Paul & Kansas City Ry., 563 Dayton Ave, St. Paul, Minn.
CHARLES H. MYERS, 2,775 Third Ave., New York City.
JOHN F. WARD, 291 Montgomery St., Jersey City, N. J.
J. Y. WHEATLEY, Asst. Eng., New York Central & Hudson River R. R. Room 21, Grand Central Station, New York City.

STATISTICS OF NEW WATER-WORKS CONSTRUCTION.

(*Specially Communicated.*)

CONTINUED FROM PAGE 418.

Brookville, Pa.—In 1886 the water company increased its capital stock to $28,000 and laid an additional mile of pipe under the direction of the Secretary. The works are owned by the Brookville Water Company; President, E. A. LITCH; Secretary and Treasurer, W. D. J. MARLIN; Superintendent, W. R. RAMSEY.

Black River Falls, Wis.—The works were commenced in August and accepted in December, 1887 they were designed by and constructed under the supervision of LOWETH & CURTIS, Civil Engineers, St. Paul, Minn. The cost of the works was $23,000. The contractors were: for masonry, foundations and brick buildings, Price Manufacturing Co.; for pumping machinery, pipe, specials, valves, hydrants, trenching and pipe laying, Philip Beuhner, of St. Paul; for stand-pipe, Price Manufacturing Co., sublet to Riter & Conley, of Pittsburg. The pumping plant consists of pumps by Gordon & Maxwell, Hamilton, O., with a daily capacity of 1,000,000 galls.; the boilers are of steel. The Galvin valves and hydrants are used. The prices paid for trenching, pipe and pipe laying were from 63 cts. for 4-in. to $1.50 for 10-in. pipe. The stand-pipe is 16 ft. diameter and 100 ft. high. The supply is taken from a filter gallery, The works were built and are owned by the city; F. W. COLE, Mayor. The present population is estimated at 2,500.

Merchantville, N. J.—The works were commenced in September, 1886 and accepted in March, 1887; they were designed by and constructed under the supervision of ISAAC S. CASSIN and HOWARD MURPHY, Civil Engineers, of Philadelphia, Pa. The contractors were, for buildings, E. Tilton, Merchantville; pumping machinery, Holly Manufacturing Co., Lockport, N. Y.; pipe and specials, McNeal Pipe & Foundry Co., Burlington, N. J.; trenching, pipe laying and reservoir, S. L. Bartholomew; valves and hydrants, Union Hydraulic Works, Philadelphia; stand-pipe, C. E. Tippett. The stand-pipe is 100 ft. high. The works are owned by the Merchantville Water Co.; President, A. G. CATTELL,; Secretary, E. S. HALL; Superintendent, E. S. THORP. The hydrant rental is $30. The present population is estimated at 1,000.

[NOTE.—H. R. Worthington, New York, writes us that their firm furnished the pumping machinery for Nebraska City, Neb., to Messrs. Comegys & Lewis, the contractors for the entire work, and that it was a mistake to mention the Pond Engineering Co., as the contractors for the machinery (see p. 418). We would state, however, that the information in the item al-

luded to was specially communicated to us by the constructing engineer of the works.)

NOTE.—The above stat stics of new construction are sent in response to special inquiri s sent out by us to contractors, superintendents, engineers and others having to d> with new works. We have a special blank for this service, and will be pleased to forward one or more on application. We invite co-operation in this special subject.

(TO BE CONTINUED.)

CONSTRUCTION NEWS.

Water.

Sewerage for Ware, Mass.—The Road Commissioners have engaged Mr. DAVIS, C. E., of Northampton, Mass., to prepare the plans and specifications for the new system of sewerage.

Pittsburg Pa.—There have been many complaints lately as to the want of sufficient pressure in the mains of the Monongahela Water Co. on the South Side. The matter is being looked into by the Common Council.

Albany, N. Y. (CORRECTION).—We are informed that the paragraph on page 418 (which was made up from particulars given in an Albany daily paper) is incorrect. The plans are not yet commenced, and have therefore not been presented to the commission; but a general statement was made in a preliminary report which was presented, outlining the general plan of the work. The surveys have been commenced. Mr. Mars is not the engineer to the commission, but is the engineer in charge of the engine houses. J. M. DEVARONA is the engineer.

Lincoln, Neb., Sewerage.—When the $80,000 bonds for a sys em of sewerage were sold, the proceeds amounted to $80,734.71, and of this sum $52,804.50 has been expended in laying 10 miles of pipe, leaving $27,930.21 (less $3,000 to $4,000 for outstanding obligations) for the remaining 5 miles. O. N. GARDNER, City Engineer, thinks the work can be completed within the appropriation as the actual cost for labor and material on the finished 10 miles was only $43,338.65. On this part of the work 20, 18, 15, 12, 10 and 8-in. pipe has been used and the trench has averaged 15 ft. in depth, while on the 5 miles now under construction 6 or 8-in. pipe will be used and the trench will only average 10 ft in depth. DUFFET & RAMSAY are the contractors, and are doing the work on schedule prices and not for a lump sum.

Water-Works Legislation in New Jersey.—The Senate and General Assembly has enacted the following laws relating to water-works: (1). Chapter XIII: An act to authorize municipal corpocations not owning or controlling water-works to contract with adjacent municipal corporations owning or controlling water-works for supplying water for a term of years; bonds to be issued to pay for the expenses of laying pipes, setting hydrants, etc., the entire issue of bonds not to exceed ⅓th of the value of the real estate of the corporation. The water to be supplied to the inhabitants at certain rates and under rules to be determined by the governing body. The act is inoperative until assented to by a majority of legal votes.—(2) Chapter XXVII. An act supplementary to the act to enable incorporated towns to construct water-works, authorizing the issue of an amount above the original limit of $60 000 when such limit is insufficient; the amount to be raised for the construction of the works not to exceed $100,000 and to be duly voted upon after public notice.—(3) Chapter XXVIII; Another act supplementary to the act to enable incorporated towns to construct water-works, authorizing the commissioners of such towns as have constructed works under the original act, to make extensions of the pipe system.

Water Companies.—The Farmington Water Co., Farmington, Me., has the following officers: President, CHAS. W. KEYES; Vice President, Dr. F. H. RUSSELL; Treasurer, Dr. J. J. LINSCOTT; Secretary, Philip W. HUBBARD.

The Warsaw Water-Works Co., Warsaw, N. Y., has elected C. L. MORRIS, President, and E. H. MORRIS, Secretary.

The Lookout Water Co., Chattanooga, Tenn., has elected W. S. KUHN, of McKeesport, Pa., as President, to succeed Col. A. M. JOHNSON, resigned.

The Artesian Water Co., Memphis, Tenn., has elected the following officers: President, R. C. GRAVES; Vice President, JOHN JOHNSON; Treasurer, N. M. JONES; Secretary, JOHN J. WELLER.

New Water-Works.—Portland, Me. The Portland Water Co. will issue bonds for $1,500,000 for refunding the outstanding bonds and constructing new works. A new reservoir will be built on Munjoy hill.—Camden, Me. Water was turned on by the Camden & Rockland Water Co. on June 17.—Farmington, Me. The Farmington Water Co. has made a new contract with the corporation. There is a strong feeling in favor of establishing a water supply.—Dover, N. H. A vote on the question of establishing water-works at a cost of $350,000 will be taken July 19. An almost unanimous favorable vote is expected.—Taunton, R. I. The Water Commissioners propose to bore artesian wells.—New Hartford, N. Y. The water-works question is again being agitated and the commissioners have visited Clinton and Richfield Springs to examine the works.—Montclair, N. J. Work has been commenced on the well for the new water supply; it will be 36 ft. in diameter.—Catonsville, Md. Water having been reached by the artesian well funds are to be raised to pipe the water to the houses.—Findlay, O. A vote will be taken July 19 on the question of establishing works.—Marietta, O. Address J. H. GRAFTON.—Delaware, Ill. The works are nearly completed.—Clinton, Ill. The City Council has decided to establish water works, and has ordered plans and specifications to be made. The first expenditure will be about $30,000 and the matter is to be taken in hand at once.—Austin, Minn. The city has voted 127 to 88 in favor of bonding the city for water-works. The plan is for a system of wells for a domestic supply and a fire supply from the river. The estimated cost is from $25,000 to $40,000. Address Mayor FRENCH.—Scotland, Dak. The new works will call for about 3,600 ft. of 6-in. or 8-in. mains and a reservoir. Address G. G. LINDLEY.—Janesville, Wis. The plans for the water-works are not yet completed.—Macon, Ga. The company refuses to sign a two years contract, and the mayor has expressed himself in favor of five years.—Americus, Ga. The water-works bonds will soon be put on the market. The total issue is for $30,000.—Chattanooga, Tenn. Work has been commenced on the new pump house of the Lookout Water Co.; the improvement will cost $150,000. The St. Elmo water-works are completed.—Sanford, Fla. The Sanford Water-Works Co. is improving its works; putting in a new pump with a daily capacity of 1,000,000 galls., laying new mains, building a new reservoir, etc.—Meridian, Miss. The water-works built by the Meridian Water-Works Co. were accepted by the city authorities on June 23.—Cartersville, Mo. J. B. QUIGLEY, of St. Louis, Mo., has made a proposition to put in water-works.—Bird City, Kan. The city has voted to issue bonds for a system of water-works. Address J. H. HUMLONG, City Clerk.—Newport, Ark. The works are approaching completion.—Seward, Neb. It is proposed to issue $21,000 for water-works; the matter will be voted on July 8.—Norfolk, Neb. The city is about to contract for a system of water-works to cost $50,000.—North Platte, Neb. The plans for the new works are in preparation. Address Mayor HAMMOND.—Falls City, Neb. The city has voted in favor of issuing bonds for $24,000 for water-works by a vote of 324 to 3.—Glenwood Springs, Col. The De Lan proposition for a water supply has been accepted.—Independence, Cal. Water-works are to be established at once.—Alameda, Cal. The city will be supplied by the Oakland Water Co.

Proposals Open.

Culvert.—Arch culvert, 20 ft. span, on the Pittsburg, Virginia & Charleston Ry. at Lobbs run. Plans and specifications at the office of the Assistant Engineer, Monongahela division, Pittsburg, South Side. D. M. WATT, Superintendent of Monongahela division, Pennsylvania R. R., Pittsburg, Pa. July 5.

Street Work.—Grading, macadamizing and paving gutters. E. F. LAYMAN, C. E., 49 W. 3rd. street, Cincinnati, O. July 5.

City Work.—Grading, ballast, curbstone, cedar block paving on sand foundations, crosswalks, culverts, etc. WM. H. LANGLEY, President, Board of Public Works, Detroit, Mich. July 5.

Sewers.—Six miles of brick and tile sewers at Green Island, N. Y. Plans and specifications at the engineer's office, Green Island, and at the office of Landreth & Fitzgerald, Schenectady. MICHAEL KEATING, Secretary, Sewer Commissioners, Green Island, N. Y, July 6.

Water Supply.—Additional supply, contractor to guarantee 2,000,000 galls. per day. W. J. COOPER, Chairman, Water Committee, Lincoln, Neb. July 6.

Bridge.—Over the Passaic at Avondale Engineer, James Owen, 721 Broad St., Newark, N. J. Substructure and iron superstructure. C. F. HARRINGTON, Chairman, Joint Committee Essex & Bergen counties, Kingsland, N. J. July 6.

City Work.—Sewers, Belgian paving and concrete paving. ALBERT B. HILL, City Engineer, New Haven, Conn. July 6.

Pumping Engine.—Including boilers, etc.; daily capacity 20,000,000 galls. The Water Commissioners, Buffalo, N. Y. July 8.

Street Work.—Regulating, granite and trap block paving. The Commissioner of Public Works, New York City. July 8.

Water Works.—Proposals for the whole work or parts thereof. THOS. W. BUTLER, City Clerk, Jerseyville, Ill. July 8.

Dredging.—Channel across North river bar, N. C. Capt. F. A. HINMAN, U. S. Engineer Office, Norfolk, Va. July 11.

Boiler and Tanks.—In Troy Hill pumping station; iron tanks 40 ft. diameter and 21 ft. high. JAMES BROWN, Comptroller, Allegheny, Pa. July 11.

Castings.—For sewerage purposes. Information at the office of the City Engineer. JAMES BROWN (*as above*). July 11.

Dredging.—At Parda Hook, 12,000 cu. yds.; at Bogart Light, 5,000 cu. yds.; at Stuyvesant, 3,000 cu. yds. JAMES SHANAHAN, Superintendent of Public Works, Albany, N. Y. July 11.

Masonry.—Ten piers in the Missouri river at Great Falls: cut stone laid in cement, 1,100 cu. yds. J. T. DODGE, Engineer of Great Falls Townsite Co., Helena, Mont. July 12.

Surface Railroad.—Cable or electric road wanted. S. L. MINER, President, Fairmount Improvement Association, Box 649, Cincinnati, O. July 12.

Dredging.—At pier 59, North river. THE DOCKS COMMISSIONERS, Pier A. North river, New York City. July 13.

Crib Work.—Re-connection between suction pipe and cribwork in the lake. T. A. THOMPSON, Chairman, Water-Works Board, Parkdale, Ont., Canada. June 14.

Cleaning, Earthwork, Etc.—Plans and specifications at the office of HARRISON WAITE, Petersburg, Va. S. P. ARMINGTON, Secretary, Roanoke Navigation & Water Power Co., Warrenton, N. C. July 15.

Pumping Plant.—Pumping engines and boilers with a capacity of 2,000,000 galls. per day to raise water from the McTavish reservoir to the High Level reservoir. LOUIS LESSAGE, Superintendent of Water Works, Montreal, Canada. July 15.

Bridge.—Two sand stone abutments; iron piling for substructure; iron or wooden superstructure, 122½ ft. span. FRANK J. REINHARD, County Auditor, Columbus, O. July 15.

Street Work and Pipe Drains.—THOS. J. LANAHAN, Clerk, Board of Contract & Apportionment, Albany N. Y. July 18.

Pipe Laying and Pumping Station.—Cast-iron pipe; 450 ft. of 12-in., 2,650 ft., of 8-in., 9,350 ft. of 6-in., 3,000 ft, of 4 in.; bids per lin. ft. laid, and valves, hydrants, etc., set. Pipe, valves, hydrants, etc., furnished by the city. Separate bid for building pumping station. H. H. HARRISON, (Consulting Engineer for the city of Hudson, Wis.,) Stillwater, Minn. July 18.

Sewers and Appurtenances, Manhole Covers.—At Clifton, O. ARTHUR S. HOSBY, C. E., Johnson Building, Cincinnati, O. July 20

Pipe and Pipe Laying.—Furnishing and laying 1,812 ft. of 6-in. cast-iron water pipe, 4 valves, and 6 hydrants; also 1,985 ft. of 8-in. vitrified drain pipe, 19 4-in. Y in'ets and 5 manholes; at San Antonio. JOHN SIMPSON, A. Q. M., U. S. A., San Antonio, Tex. July 23.

Contracting.

Lamp Posts.—The following proposals were received recently by F. W. KING, General Superintendent of Lamps, Baltimore, Md.: J. Vernon Campbell, 2¾ cts. per pound; E. D. Miller, 2¾ cts.; H. C. Larrabee & Co., 2¾ cts.

Breakwater.—The following proposals for repairing 840 ft. of the superstructure of new breakwater at Oswego, N. Y., from the shore end to the angle, were opened June 25 at the U. S. Engineer Office, Oswego, N. Y.: J. B. Donnelly, Oswego, $26,937.52; Geo. Talbot, Buffalo, $28,357.51; Daniel McConnell, Buffalo, $29,992.71.

Dredging.—The following proposals for dredging 30,000 cu. yds. at the outlet of Crooked lake, were opened June 24 by JAMES SHANAHAN, Superintendent of Public Works, Albany, N. Y.: A. B. Wright, Geneva, 34 cts. per cu. yd.; W. Johnson, Fulton, 36 cts. Contract awarded to A. B. Wright.

Water Pipe.—The following proposals for cast-iron water pipe were received June 27 by the Board of Public Works, Jersey City, N. J.: Thos. J. McKenna; 6-in, $35,90; 8-in., $35.90; 16-in., $35.90, per ton of 2,240 pounds. John Fox, New York: $35.50, $35.50, $35. M. J. Drummond, New York, $37 for all sizes. R. D. Wood & Co., Philadelphia, $37.80, $37.80, $37.30. W. W. RUGGLES is Chief Engineer.

Pumping Engine.—The following is a corrected list of the proposals for the pumping engine for Camden, N. J.: Holly Manufacturing Co., Lockport, N. Y., $29 500, $29.500. Davidson Steam Pump Co., New York, $34,800, $28.000. H. R. Worthington, New York, $30.750, $18,175, $21,175. Geo. F. Blake Manufacturing Co., New York, $32,400, $35,500, $45,000. Dickson Manufacturing Co., Scranton, Pa., $67.500. [The list given on page 419 was furnished us by W. W. MINER, Engineer, Water Department, Camden.]

Street Work.—The following contracts for regulating, grading, curbing and flagging were awarded June 23 by the Commissioner of Public Works, New York City: (1). On 90th street; D. R. Collins, earth excavation, 50 cts. per cu. yd.; rock excavation, $1.35 per cu. yd.; curbing, 60 cts. per lin. ft.; flagging, 30 cts. per sq. yd.; total, $1,837.10.—(2). On 90th street; only one bid; rejected.—(3). On 91st street; D. R. Collins; 30 cts., $1.40, 60 cts., 25 cts., filling, 10 cts. per cu. yd.; $5,816.82.—(4). On 91st street; all bids rejected.—(5). On 114th street; James Slattery, curb, 58 cts.; flagging, 24 cts.; filling, 13 cts.; $5,005.63.—(6). On 115th street; D. R. Collins, curb, 60 cts.; flagging; 28 cts.; filling, 18 cts.; $5,114.76

—(7). On 121st street: Andrew Low, earth excavation, 25 cts.; curb, 67 cts.; flagging, 25¼ cts.; filling, 29 cts.; $2,057.70.—(8). On 142nd street: Boitano & Reilly, earth excavation, 15 cts.; rock, $1.50; curb, 75 cts.; flagging, 28 cts.; filling, 25 cts.; stone masonry excavation, $1 per cu. yd.; $3,285.60.—(9). On 161st street; M. Fay; earth excavation, 47 cts.; rock, $1.69; curb, 65 cts.; old curb, 17 cts.; flagging 33 cts.; $9,217.30.—(10). On 165th street; M. Fay; earth, 59 cts.; rock, $1.87; curb, 69 cts.; flagging, 33 cts.; $5,402.84.

The following contracts for similar work were awarded June 28: On 98th street; Matthew Baird; pavement, $2.44 per sq. yd.; total, $6,808.52.—On 99th street; P. H. Fitzgerald, $2.39, $5,588.30.—On 94th street; P. H. McCullagh, pavement, $2.75 per sq. yd.; bridge stone, 65 cts. per sq. ft.; total, $9,830.75.—On 99th street; P. H. Fitzgerald, $2.39, 65 cts., $2,977.72.—On 116th street; P. H. Fitzgerald, $2.35, 48 cts., $12,518.05.—On 123rd street; Wm. Kelly, $2.65, 50 cts., $14,030.45.—On 133rd street; Wm. Kelly, $2.65, 50 cts., $14,293.80.—On 134th street; Matthew Baird, $2.45, 50 cts., $6,796.36.

The contract for regulating, grading, setting curb stones and flagging sidewalks on Kingsbridge road, was awarded June 28, by the Commissioner of Public Works, New York City, to B. F. Coleman, at the following prices; earth excavation, 30 cts. per cu. yd.; rock excavation, $1.25 per cu. yd.; filling, 65 cts. per cu. yd.; curb, 70 cts. per lin. ft.; flagging, 30 cts. per sq. ft.; culverts, $4 per lin. ft.; iron frames and gratings, $10 each; 12-in. pipe, $1 per lin. ft.; bridge, $360; total, $204,990. The other bidders were; Ross & Sanford, $218,468; Thos. E. Crimmins, $271,892; Robt. J. Williams, $345,046; James Slattery, $361,850.

Railroad Contracts.—Mason, Hoge & Co. have the contract for the entire 32 miles of the first division of the Cumberland Valley branch of the Louisville & Nashville R. R., and unless delayed by further trouble from water in the 1,100 ft. tunnel will finish their contract by the end of August.

Albert Pitcairn has the contract for the West Virginia R. R.; Tennent & Johnson are the sub-contractorz.

R. B. Langdon, of Minneapolis, Minn., has the contract for a branch 9 miles long from Hopkins station on the Chicago, Milwaukee & St. Paul R. R., to the St. Louis hotel at Lake Minnetonka.

John W. Rutherfoord, of New York, has the contract to build from Springfield, Ill., to Emden, 40 miles, and from Emden to Eureka, 35 miles, where the line will connect with the Chicago line of the A. T. & S. F. R. R. The line is for the St. Louis & Chicago R. R. Co.

Louis McLain, of Savannah, Ga., has contracted to complete the Savannah & Tybee Ry. by August.

J. R. DeRemer has the contract for a ten-mile branch of the Denver, Texas & Fort Worth R.R., from Trinidad, Col.

J. J. Brown & Co. have the contract for grading the first 50 miles east of Trinidad, Col., for the Denver, Texas & Fort Worth R. R.

The Neil McDonald New York Railroad Supply Co. has the contract for the Mobile & Dauphin Island R. R. from Mobile, Ala.; length, 26 miles. The bridges will be built by the Phœnix Bridge Co., and the steel rails will be supplied by the Tide Water Steel Works, Chester, Pa.

The Georgia Construction & Investment Co. has the contract for the Carolina, Knoxville & Western R. R.

James B. Orman, of Pueblo, Col., has the contract for altering the track of the Denver & Rio Grande R. R., between Salida and the Royal Gorge to accommodate a third rail. There will be a tunnel 500 ft. long near near Badger station.

The New York Contract Co. has the contract for grading and ties for the Alabama, Florida & Atlantic R. R., from Indian Springs to Silver Springs, Fla.

Harroldson, Sharp & Co. have the contract for grading, and C. A. Weeks has the contract for trestles and track laying on the Dallas & Oak Cliff Elevated Ry., at Dallas, Tex.

McRae & Lally, of Detroit, Mich., have the contract to build the extention of the Detroit, Lansing & Northern R. R. from Grand Ledge to Grand Rapids, Mich.

T. Raphael, of Ottawa, Canada, has the contract for a double track on the Grand Trunk Ry., between York and Scarboro, 9 miles. Part of the double tracking between Montreal and Toronto is being done by the company and part by contract.

S. R. Bullock & Co., of New York, have the contract to build the Roanoke & Southern R. R., in Virginia.

H. Davins, of Lexington, Ky., and M. Walton have contracts for 10 and 25 miles of the Clinch Valley R. R.

Ricker, Lee & Co., of Galveston, Tex., have the contract to extend the Gulf, Colorado & Santa Fé R. R., from Cleburne, Tex., to Weatherford, 42 miles.

W. W. Jackson, of Charlotte, N. C., has the contract for grading the Charleston, Cincinnati & Chicago R. R., near Yorkville, S. C.

Roche & Tierney have the contract to extend the St. Louis, Arkansas & Texas R. R. from Corsicana, Tex., to Hillsboro. H. W. Holden has a sub-contract for 5 miles.

City Improvements.—Plattsmouth, Beatrice, and Nebraska City, Neb., are having grade plans prepared and sewerage systems designed by ROSEWATER, CHRISTIE & LOWE, civil and sanitary engineers, Omaha, Neb. The firm is also designing a system of sewerage for Wichita, Kan.—Hon GEO. S. MILLER, proprietor of Seymour Park, a suburb of Omaha, has ordered waterworks, sewerage and electric light systems to be put in at once.

Brick Paving.—At Youngstown, O., only one bid for brick paving was received by J. M. RENO, City Engineer. The prices were as follows; excavation, 45 cts. per cu. yd.; agricultural tile, 4 cts. per lin. ft.; setting curb, 10 cts. per lin. ft.; furnishing and setting curb, 30 cts. per lin. ft.; furnace slag foundation, 40 cts. per sq. yd.; furnishing and paving brick, $1.45 per sq. yd. Total bid, $38,389.25.

Sewerage System Wanted.—West Bay City, Mich., has raised $60,000 by bonds, for the purpose of commencing the construction of main or trunk sewers in said city. It is desired that the city be laid out in sewer districts, with the location of main or trunk sewers. Plans and specifications are solicited. For particulars address W. H. PHILLIPS, Clerk, Board of Public Works, West Bay City, Mich.

Sidewalk Work.—The contract for sidewalk work in Sidewalk District No. 2, Little Rock, Ark., has been awarded to Henry Rudd, at the following prices: excavation, 11 cts. per lin. ft.; tearing up walks, 4 cts.; reset old curb, 7 cts.; new curb, 33 cts.; excavating alleys, $1.40; paving alleys, $40; tearing up old gutters, 6 cts.; all per lin. ft.; relaying gutters, 28 cts. per sup. yd. The contract for concrete was not let. FRED. J. H. RICKOS, City Engineer.

Water-Works.—The Gowanda Water-Works Co., of Gowanda, N. Y., has awarded the contracts for the reservoir and pipe laying to Bassett Bros., and Hardricke & Ware, both of Buffalo, N. Y. The work is to be completed by October.

The contract for the water works at Van Buren, Ark., has been awarded to the Water, Light & Power Co., St. Louis, Mo. The supply will be brought from a distance of 2 miles through a 10-in. pipe to a reservoir with a capacity of 250,000 galls. There will be 3 miles of distribution pipe within the town.

Asphalt Paving.—The only proposal for asphalt paving, received June 25 by JOHN W. MCDONALD, Superintendent of Streets, Boston, Mass., was from the Barber Asphalt Paving Co., New York, at $3.50 per sq. yd. The specification called for a Trinidad asphalt pavement of 2½ ins. in thickness after compression, upon a base of thoroughly rammed hydraulic cement concrete 6 ins. thick—the concrete to be composed of the best quality of American cement, mixed with clean, sharp sand in the proportion of 1 part cement to 2 of sand, to be made into mortar with the least quantity of water. Angular, broken stone shall be immediately mixed with this mortar in such quantity as to allow a a surplus of mortar after ramming. The price is per square yard of surface for laying the pavement, including the foundation and the keeping of said pavement in good repair for five years—all excavating and preparation of bed under foundation to be done by the city.

Mississippi Bridge.—The following proposals for the construction of the superstructure of the high bridge across the Mississippi river from Forbes street to Mohawk avenue, have been received by the Department of Public Works, St. Paul, Minn.: Morse Bridge Co., Youngstown, O.; Plan A, $311,000; Plan B, $324,000. Edge Moor Iron Co., Wilmington, Del.; Plan A, $376,400; Plan B, $363,400. Keystone Bridge Co., Pittsburg, Pa.; $340,324. M. Lassig, Chicago, Ill.; $435,000. The bridge will be a wrought-iron deck structure and will have two trusses, 22 ft. center to center; there will be a roadway 24 ft. wide and two sidewalks, 6 ft. wide each. The total length will be 2,770 ft. between abutments, with spans as follows: four 40 ft. tower spans, three 80 ft. tower spans and two 60 ft. spans, all riveted plate girders; nine 80 ft. and five 90 ft. spans, riveted lattice girders; one 170 ft. and four 250 ft. spans, pin connected trusses. The trusses and girders will be carried on iron trestle bents. The work will be under the supervision of L. W. SUNDLETT, City Engineer.

Bridge Contracts.—Lawrence, Mass. The following proposals have been received for a new iron bridge across the Merrimack river, to replace the bridge recently burned: Rochester Bridge Co., Rochester, N. Y., $35,000; Niagara Bridge Co., $37,300; Boston Bridge Co., $39,790.—Paterson, N. J. The contracts for the bridge across the railroad at William street have been awarded to the Passaic Rolling Mill Co., of Paterson, for the iron work, and to Martin Hogan for the masonry.—The Penn Bridge Co., Beaver Falls, Pa., has the contract for a double track, pin connected bridge of 4 spans on the Pittsburg, Fort Wayne & Chicago R. R. between Beaver Falls and New Brighton. M. Gwinne of Pittsburg, has the contract for the masonry.—Chicago, Ill. The following proposals have been received for the single track street bridge at 16th street: Substructure; Chicago Dredging & Dock Co., $39,444; Green Bay Dredging & Dock Co., $39,994; James A. McMahon, $40,179; Fitz Simons & O'Connell, $40,197. Superstructure; King Iron Bridge & Manufacturing Co., Cleveland, O., $21,500; Detroit Bridge Co., $25,950; W. J. Coolidge & Co., Chicago $27,750; G. Ulrich & Co., $27,800.—The California Bridge Co., San Francisco, Cal., has the contract for an iron and steel bridge 3000 ft. long, for the San Francisco & Northern Pacific R.R. Co., across Petaluma creek. There will be a draw with two openings of 100 ft. each and the remainder will be trestle work. The company will also build a bridge 150 ft. long, with a 43 ft. draw, across Novado creek, for the same railroad. The total cost of bridges and trestle will be $60,000.

RAILROADS.

[With the beginning of a new volume we make some changes in the arrangement of our news of railway construction. The main divisions are geographical, in order that the reader may find the news from the particular section in which he is interested, classed by itself. The division "East of Chicago" includes Michigan, Indiana, Ohio, the Middle States, New England, Quebec and Ontario. "Southern" includes Virginia, West Virginia, and the states south of the Ohio and east of the Mississippi. "The Northwest" includes Illinois, Wisconsin, Manitoba and the provinces west, Minnesota, Dakota, Nebraska, and Iowa. "The Southwest" includes Missouri, Kansas, Indian Territory, Arkansas, Louisiana and Texas. And "Rocky Mountain and Pacific" indicates the states and territories west of those already named and also Mexico. The work in each section is subdivided under "Existing Lines" and "New Projects and Surveys." The latter includes all news of lines that have not yet progressed far enough to let a *bona fide* contract for construction and are not directly controlled by some existing road; and the former, all news of the extensions or projects of old lines and of the work on new lines whose construction has actually begun.—ED. ENG. NEWS].

East of Chicago.

Existing Roads.—*Dayton, Fort Wayne & Chicago.*—The directors of this company, which was recently formed by the consolidation of the Dayton & Toledo and Dayton & Ironton companies, have ratified the lease to the Cincinnati, Hamilton & Dayton and ordered the construction of the extension to Fort Wayne to be put under way.

Cincinnati, Hamilton & Dayton.—At the recent annual meeting the directors voted to construct or lease a branch line from Hamilton, O., to Middletown and thence north to connect with the main line. This may be a move toward closer relations with the Louisville, Cincinnati & Dayton, which now runs from Hamilton to Middletown and is under construction to Louisville, Ky.

Somerset.—The proposed lease to the Maine Central seems to have fallen through; but the extension to Bingham will be built notwithstanding this.

International.—The contractors now have 2,000 men at work in northern Maine and wish to increase the force. There is much heavy rock work on the line. One trestle east of Moosehead lake is 130 feet high.

Boston & Maine.—It is stated that this company may undertake the construction of the proposed Sanford & Kennebunk line.

Baltimore & Ohio.—All but 30 miles of the Philadelphia extension has been double tracked. The Pittsburg Junction railway, which was granted permission to build extensions in the city of Pittsburg exceeded their permit by laying track to the Fort Wayne bridge and the tracklaying has been stopped by the authorities.

New Projects and Surveys.—*Canadian.*—The Minister of Railways and Canals has given notice of the following Government subsidies:

Name of road.	Mileage.	Amount.
Drummond County	30	$96,000
Beauharnois Junction	30	96,000
Massawippi	10	32,000
Arthabaska & Wolf	7	22,400
Jacques Cartier Union		20,000
Chicoutimi & Lake St. John	30	96,000
St. Lawrence & Lower Laurentian	50	217,600
Lake Temiscamingue	2	12,400
Carillon & Grenville	12	38,400
Lake Temiscamingue Colonization	10½	33,600
Montreal & Champlain Junction		64,000
Quebec & Lake St. John	9	28,800
Temiscouata	30	96,000
Canada Atlantic (bridge at Coteau Landing)		180,000
Muncie Branch	5½	17,600
Leamington & St. Clair	3	6,400
Cumberland	14	44,800
Cornwallis Valley	13	41,600
Nova Scotia Central	34	108,800
Tobique Valley	14	89,600
Woodstock & Centreville	20	64,000
Lake Erie, Essex & Detroit River	27	118,400
St. Catharines & Niagara Central	12	38,400
Vaudreuil & Prescott	30	96,000
Richmond Hill Junction	5	16,000
Joggins	1¾	4,600
Moncton & Buctouche	3	6,400
Harvey Branch	3	9,600
Brantford, Waterloo & Lake Erie	19	97,600
Guelph Junction	16	51,200
Napanee, Tamworth & Quebec	4	12,800
Teeswater & Inverhuron	24	76,800
Oshawa Ry. & Nav	7	22,400
Ontario & Pacific	6	19,200
Carsquet	1	3,200
St John Valley & River Du Loup	20	70,400
South Norfolk	17	54,400
Great Eastern	30	96,000

Thirty-eight companies are given subsidies amounting to $2,188,600 upon a total of 554 miles. All roads subsidized are required to commence construction within two years and complete in four.

Penobscot Central.—The survey from Milo to East Corinth has resulted in finding a very feasible route. Negotiations for a lease to the Bangor & Piscataquis are still in progress.

Erie & State Line.—Incorporated in Pennsylvania to build from the New York to the Ohio State line, 44 miles.

Baltimore & Drum Point.—The commissioners of Anne Arundel county are doubtful about indorsing the bonds of this company and have postponed decision till July 5. The Baltimore & Drum Point road was to be 72 miles in length and the contractor was to receive for its construction $600,000 in country and private subscriptions and $2,150,000 of the company's stock and bonds, or about $38,200 per mile. A movement is now under way for building a line from Drum Point to Annapolis to connect with the Annapolis & Baltimore Short Line, thus giving Calvert county a line to Baltimore with the construction of 50 miles of line instead of 72.

Seaconnet.—This long talked of project in Rhode Island is at last to be put under way. The line is to run from Tiverton, on the Old Colony R. R., to Seaconnet Point, 13 miles. EDWARD O. CHILDS, of Newton, is President and HENRY W. WILSON of Boston is Chief Engineer.

Poughkeepsie & Delaware Valley.—This company has organized in the interest of the New York, Ontario & Western to effect a connection with the Poughkeepsie bridge by a line from Bloomington.

Southern.

Existing Roads.—*Louisville Southern.*—The grading on this line is making good progress. Engineers are now locating the last section from Harrodsburgh to Danville and when completed will make the final location of the branch from Lawrenceburgh to Lexington.

Shenandoah Valley.—Under the reorganization plan which is now before the bondholders of this company, the line is to come into still closer relations with the Norfolk & Western. It is also proposed to build a line from Luray to Washington to give the Pennsylvania direct connection with the Norfolk & Western system.

St. John's & Halifax.—This Florida line is to be extended across the St. John's river to Palatka, the bridge being now under construction. The St. Augustine & Palatka will probably extend to Rolleston and cross the river over the same bridge.

Tavares, Apopka & Gulf.—The southern extension of this Florida line is making rapid progress, and it is hoped to reach Bartow by the end of the year.

Atlanta & Hawkinsville—An endeavor is being made to enlist English capital in the construction of this line. Grading is being pushed and some 16 miles are finished on the northern section. Tracklaying is to begin July 20.

Central R. R. of Georgia.—The final location is in progress on the lines from Blakeley to Columbus, from Clayton to Ozark, and from Troy to Elba.

Ohio Valley.—The track is laid to Princeton, Ky.

New Projects and Surveys.—*Louisville, Cincinnati & Virginia.*—A company has just been organized under this charter, granted by the Kentucky legislature three years ago, to construct a line from Winchester, Ky., to the Virginia State line and a connection with the Norfolk & Western. Among the incorporators are DOUGLASS GREEN and F. K. HAIN of New York and T. G. STUART of Winchester, Ky.

Pensacola & Birmingham.—E. E. SAUNDERS, of Pensacola is President of this newly incorporated Florida company.

Palatka, Welaka & Lake.—The survey of this Florida road, is in progress. Maj. C. B. FENWICK of Palatka is General Manager.

McKenzie & Tennessee River.—Organized at McKenzie, Tenn., to build a line southeast to the Tennessee river, 30 miles.

Knoxville Southern.—This company has been chartered at Knoxville, Tenn., R. M. PULSIFER of Boston is President. The line is to run from Knoxville to a connection with the extension of the Marietta & North Georgia. The company asks $300,000 aid from the city of Knoxville. The Atlanta, Knoxville & Northwestern and Tennessee Midland companies have also asked the same amount of aid.

Tennessee Midland.—The officers of this company have filed a charter for the Knoxville & Midland R. R. Co., for the purpose of placing Knoxville on their main line.

The Northwest.

Existing Roads.—*Chicago, St. Paul, Minneapolis & Omaha.* The new Dakota line from Salem to Mitchell was opened for business on Monday. Amended articles of incorporation have been filed of the Northeastern Nebraska, which is the branch running from Wayne to Niobrara on the Missouri river.

Chicago & Northwestern.—It is stated that ways and means are being canvassed for a Kansas City extension, but as the statement comes from Kansas City, it should be correctly weighed. About 50 miles of the extension west from Douglas, Wyo., have been graded. It is rumored that a branch of this line is to be pushed on northwest to the Montana mining districts.

Minnesota & Northwestern.—A line to Duluth is said to be under consideration.

Red River Valley.—The work on this line is to be pushed with all the hands that can be obtained, and it is hoped to complete the grading in one month and have the rails laid by Sept. 1. The Northern Pacific engineers have completed the location of the line from Grand Forks to the boundary, and Contractor FOLEY will begin the grading at once. Thus the competing line which the Manitobans have been so anxious for, bids fair to become an early reality.

Chicago, Santa Fé & California.—Officials of the company have been conferring with the mayor and citizens' committee of Keokuk, Ia., with reference to a branch to that city from New Boston, and the line will probably be built. Surveyors are running a line in Illinois from Litchfield to St. Louis, and it is supposed that the St. Louis & Chicago road will be absorbed, which would give the Santa Fé a direct line from St. Louis to Chicago.

Chicago, Burlington & Quincy.—An amended charter has been filed of the Nebraska & Colorado line, authorizing $10,000,000 increase of capital stock, and locating a line through Dawson county. An extension is rumored from Rushville to Quincy, Ill.

St. Paul, Minneapolis & Manitoba.—The main part of the force now working on the Great Falls extension will be transferred as soon as that is completed to the line from Minot to Bismarck, which it is proposed to finish before cold weather. On the line from Milaca to Brainerd, the locating survey is finished and the surveyors are at work on the Brainerd & Northwestern line.

New Projects & Surveys.—*Paducah & Mt. Vernon.*—This company has been formed in Illinois by the consolidation of the Mt. Vernon & Wabash and Paducah & Mt. Vernon companies.

Omaha & Yankton.—This company has filed its articles of incorporation in Nebraska to construct a railway between the points named. Among the incorporators are H. N. SHEPHERD of Boston and SAMUEL D. MERCER of Omaha.

Chicago, East & West.—Incorporated in Illinois by JOSEPH STOCKTON and others to build a railway in Cook county.

Duluth, Pierre & Black Hills.—The preliminary survey of this line from Aberdeen to Pierre, Dak., is in progress under direction of JAS. CARSS.

Duluth, St. Cloud, Mankato & Southern.—The projectors of this Minnesota line have not yet enlisted sufficient capital to begin work. They have, however, secured a land grant from the State and may make surveys later in the season. There is some prospect of a transfer of the franchise to the Manitoba or to the Milwaukee & St. Paul.

Duluth, Willmar & Sioux Falls.—This company is obtaining subsidies and right of way at Sioux Falls and along its surveyed line in southwestern Minnesota.

Minnesota Belt Line.—Incorporated at Minneapolis by W. D. WASHBURN, J. S. PILLSBURY and others, to build railway lines in Minneapolis and St. Paul and between the cities.

The Southwest.

Existing Roads.—*Missouri Pacific.*—The graders are making good progress on the Jefferson City, Boonville & Lexington line, and tracklaying will begin July 15. The road is 118 miles in length passing through Boonville, Malta Bend and Waverley. There are 23 iron bridges on the line and the maximum grade is 16 ft. per mile. A. S. BLODGETT is the engineer in charge. Two new extensions of the Missouri, Kansas & Texas are reported to be under consideration. One running from Waco east to Trinity on the International & Great Northern and thence to some point in western Louisiana. The other line is to run from Waco down the Brazos valley to Brenham. In Arkansas the survey of the Jennings Falls and Hot Springs line is nearly completed. On the western extension of the Denver, Memphis & Atlantic's division the track is laid to Larned.

East Louisiana.—This line, owned by POITEVENT & FAVRE of New Orleans, has been opened for business from New Orleans to Abita Springs, 21 miles.

Louisville & Nashville.—It is reported at Little Rock, Ark., that this company has made all its plans for an extension west of the Mississippi and will run trains into Little Rock before the end of the year.

New Projects and Surveys.—*Chicago, Kansas & Arkansas.*—Chartered at Elwood, Kan., to build a railway from a point in Doniphan county to Little Rock, Ark.

Red Cloud, Kirwin & Southwestern.—Chartered at Kirwin, Kan., by W. T. BELFORD and others to build a railway from the Nebraska line in Smith county to Garden City, and from Kirwin northwest along the State line.

Chicago, Kansas & Southwestern.—Chartered by Congressman E. N. MORRILL, of Hiawatha, Kan., an others, to build a railway from the State line in Brown county southwest to Cowley county, 250 miles.

Louisiana & Arkansas.—The contract which this company has made with the city of Alexandria in consideration of the subsidy to be voted by the latter, calls for the commencement of construction before April 1, 1888 and the completion from Alexandria to Brinkley, Ark. within three years from that date.

Rocky Mountain and Pacific.

Existing Roads.—*Seattle, Lake Shore & Eastern.*—On this line, which is projected from Seattle, W. T., to Spokane Falls and Walla Walla, 44 miles are now being graded from Seattle to Squak coal mines, and tracklaying will begin by July 15. About the same date a further contract of 20 miles will be let of somewhat heavier work, on which the maximum grade is 1.3 per cent. F. H. WHITWORTH is Chief Engineer.

Seattle & West Shore.—This line runs north from a point on the Seattle, Lake Shore & Eastern 20 miles east of Seattle and is projected to a connection with the Canadian Pacific at New Westminster. The first section of 18 miles to Snohomish City is being graded and will have track laid by early fall. The surveyors are working on the line north of Snohomish. HENRY CRAWFORD is President.

Fort Worth & Denver.—At the recent stockholders meeting it was voted to issue $20,000,000 additional stock to complete the road to the Texas State line. Chief Engineer BISSELL reported the track laid to a point 266 miles from Ft. Worth. The entire line from Denver to Ft. Worth will be 806 miles in length.

Southern Pacific.—On the extension from Newhall the tracklayers expect to reach Santa Barbara by July 15. It is reported that surveyors are at work on a line from Yuma, Ariz., to San Diego, Cal., following nearly the route of the old Texas Pacific survey. They are also prospecting for a line from Yuma to Port Isabel near the head of the Gulf of California.

New Projects and Surveys.—*Utah Midland.*—R. R. SLATER has completed a preliminary survey to the Colorado State line and will run another line soon.

Silverton & Red Mountain Narrow Gauge—This line, mentioned last week, is intended principally for carrying ore, It will be 12 miles in length and but 2 ft. gauge.

Thermalito.—Surveys are being made for this proposed line in Butte and Colusa counties, California.

Burlington & Missouri River R. R.—On the Grand Island & Wyoming line, extending north and west from Grand Island, 100 miles of track were laid last year and about the same amount has been laid since Jan. 1, bringing the end of track just west of Grant county For 75 miles farther grading is in progress. On the Holdredge line the end of track has reached the west line of Lincoln county, 45 miles having been laid this year, and the remainder is being graded. The other lines under construction are from Wahoo to Schuyler, Crete to Grover, Culbertson to Imperial, Orleans through Furnas & Red Willow counties and the northwestern border of Kansas, and the 400 miles under contract running northwest from Central City in three branches and opening up the counties of Merrick Howard, Sherman, Greely, Valley, Loup and Garfield. The total length of lines now under contract to be completed before the close of the present year is 805 miles. G. W. HOLDREDGE is General Manager and J. S P. WEEKS, Chief Engineer.

Cable Railways.—Indianapolis, Ind. The ordinance authorizing the construction of cable lines has been passed.——St. Louis, Mo. The Fifth street line is to be operated by cable. CHRISTIAN PEPER is president.——St. Paul, Minn. The cable company commenced work July 1.——Los Angeles, Cal. The Los Angeles Cable Railway Co. has been incorporated by Hon. J. F. CRANK, CHARLES FORMAN and others; capital stock, $2,500,000. There will be 10 miles of road, gauge 3 ft. 6 ins. The company owns franchise for 65 miles of street railways, some to be operated by horse power.——The Metropolitan Cable Co., Omaha, Neb., has commenced work July 1st, on the construction of six miles of road. ROBERT GILHAM is Consulting Engineer.

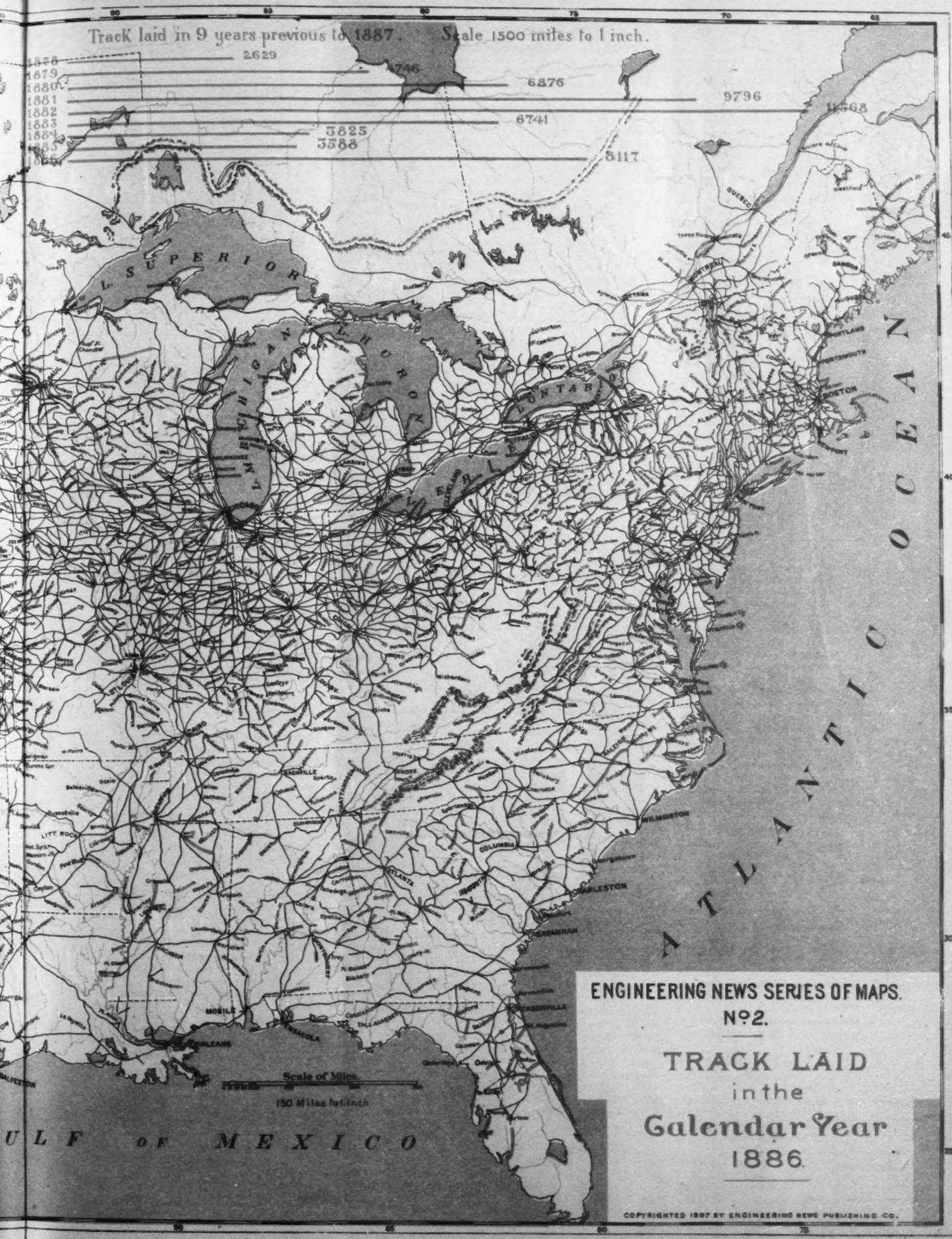
Electric Railways.—Asbury Park, N. J. Work is in progress on the electric railway.——Montgomery, Ala. On June 23 the Capital City Street Railway Co. began operating its cars by electric motors. One motor can pull 3 loaded cars at a speed of 10 to 15 miles per hour. There are 4 lines, aggregating 15 miles, a considerable portion being double track.——Riverside, Cal. The Riverside & Arlington Electric Railroad Co. has been organized by H. EVANS, Dr. J. JARVIS and others. Paid up capital, $60,000.

The Uni n for the Improvement of the Canals of New York State will hold a convention in Rochester, N. Y., on July 28. All organizations or parties interested in the work of the Union are invited to be present or to send delegates.

This map will be re-issued, corrected to date, at intervals not exceeding twelve months, and as much oftener as the activity of construction and number of changes may require.

Similar maps, covering the whole United States, Canada and Mexico **by sections** will likewise appear at least once a year each.

Subscribers and others will please **promptly advise us of all errors or omissions, as soon as detected.** All our Progress Maps are kept continuously up to date, and corrections are constantly making.



ENGINEERING NEWS SERIES OF MAPS.
No. 2.

TRACK LAID in the Calendar Year 1886.

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